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No. 24

## TRIP OF CONGRESSIONAL COMMITTEES.

PLANS OF THE LAKE CARRIERS' ASSOCIATION FOR THE FORTHCOMING EXCURSION—IRON AND COPPER MINING DISTRICTS INCLUDED IN THE PROGRAM.

The excellence of the committee appointed by the Lake Carriers' Association to arrange for the forthcoming trip of the congressional committees—the committee on rivers and harbors of the house and the committee on commerce of the senate—is assurance that the trip will be most profitable and pleasurable. The committee consists of Messrs. W. C. Farrington of Buffalo, H. A. Hawgood of Cleveland, A. W. Colton of Toledo, J. S. Dunham of Chicago, David Vance of Milwaukee, Wm. Livingstone of Detroit, A. B. Wolvin of Duluth and Secretary C. H. Keep of Buffalo. According to the present program the trip will be taken early in August. The tour of the lakes will be most thorough.

About \$5,000 or \$6,000 will very probably be expended by the Lake Carriers' Association, but there are a great number of large works planned for the general advancement of lake commerce—projects requiring in the aggregate the expenditure of many millions of dollars—and the trip will give the visiting members of the house and senate a very comprehensive view of what is needed; an idea of the vastness of the interests dependent upon the lake commerce. According to a revised program made up in Cleveland Tuesday, the congressional party, which will number at least fifty, will assemble at Buffalo on the morning of August 7. An effort will be made to induce the secretary of the treasury to place one of the United States revenue cutters at the disposal of the party while inspecting the Lake Erie harbors and the lower Detroit river. August 7 will be spent at Buffalo and Erie; August 8 at Conneaut and Ashtabula, reaching Cleveland in the evening; August 9 at Cleveland, Lorain and Sandusky; August 10 at Toledo and the lower Detroit river, reaching Detroit in the evening. The party will spend the morning of August 11 at Detroit, leaving on one of the Northern Steamship Co.'s large passenger steamers at 3 p. m. Arriving at Mackinac island on the morning of August 12, after a short stop at the island and a day run up the St. Mary's river, the party will spend about three hours at Sault Ste. Marie. Leaving the Sault on the evening of the 12th, they will reach Hancock (the copper country), via the Portage canals, on the morning of the 13th, and after a short stop there, will proceed to Duluth, reaching Duluth about midnight August 13. At Duluth the party will be entertained by the iron ore interests, who will take them on a trip, lasting a couple of days, to some of the principal iron mines in the vicinity. They will take the next boat of the Northern Steamship Co. from Duluth back to Mackinac, where they will transfer to the steamer Manitou for Milwaukee and Chicago. At Chicago the party will disband.

Besides the entertainment by the iron ore interests at Duluth, arrangements will be made by which local boards of trade and chambers of commerce at the principal ports visited will provide for the entertainment of the party.

## HUNGARIAN SHIPPING.

Consul Frank Dyer Chester of Budapest, writing to the state department, says that the law of 1893 concerning the subsidizing of Hungarian shipping having partly gone out of force at the end of the year 1898, and not having been renewed since that time, Hungarian ship owners are seriously planning to remove from Fiume to Trieste. The government has been exempting such owners from taxation, on condition that old wooden sailing vessels should be replaced by new iron-built ones. This condition has not been fulfilled, but instead the minister of finance has daily received petitions not to assess until a new law shall have been passed, and so far these petitions have been listened to.

Hungary is planning to contract for a third steamer in the Venice-Ancona-Fiume traffic, and the Adria Steamship Co. intends to increase the number of sailings to Marseilles, as well as to establish direct sailings to North Africa, Spain, Portugal and North America. For the latter, four large, new ships are necessary. The sailings to America are carried on at present by the Austro-American Co., belonging to Schenker & Co., forwarding agents, under contract with the aforesaid Adria company. From the previous income the company has only been able to build four new steamers in place of vessels lost; the last will be launched this month. If the government approves, the company will raise its capital and the government will pay something more than the present subsidy of 1,400,000 crowns (\$284,200), and the Adria will then be able to compare in every respect with the Austrian Lloyd.

Last summer an Austrian ship builder offered to build a ship yard in the Hungarian port of Porto Re, if he should receive a grant of land for that purpose. This offer, however, conflicted with the plan of the Hungarian minister of commerce to rebuild and enlarge the present ship yard in Bergudi, adjoining Fiume, at a cost of 5,000,000 crowns. This will be provided with docks, and here not only merchant steamers but also war ships will be built, inasmuch as the minister of war has promised to support the ship yard with government orders. It is expected that the Hungarian minister of commerce will hold a conference for the purpose of deciding whether this ship yard shall be built entirely at the government's expense or partly with private capital.

Col. Jared A. Smith, the government engineer at Cleveland, is to be transferred to San Francisco, and Lt. Col. S. M. Mansfield, who is now at San Francisco, is to come to Cleveland. The public announcement of the change has not been made, though it has been considered by Gen. Wilson, chief of engineers, for some time. The exact date of the transfer is not as yet known. Col. Smith succeeded Major Overman in charge of the government work here. He will leave here with cordial wishes of the vessel men for his success at the new post.

## FROM THE LAKE SHIP YARDS.

Referring to the completion of a new foundry at the works of the Craig Ship Building Co., Toledo, Mr. John Craig of that company said, a few days ago, that they were now equipped for the building of practically all parts of a ship excepting the boilers. "We did not put up a machine shop because we were desirous of doing so," he said, "but because we were forced to it." Although the Craig works are not as busy as they were some time ago, they are still employing about 400 men on the canal-size steamer building for J. L. Crosthwaite of Buffalo and on the fast passenger steamer for Mr. G. T. Arnold of Mackinaw, Mich., which is nearing completion. The Arnold steamer, which is to double the route each day between Mackinaw and the Sault, is to make on trial 18 miles an hour for five hours.

Finishing touches are being placed on the big Bessemer steamer Van Hise, preparatory to launching her next week at the Superior Ship Building Co.'s yard, West Superior. The capacity of the Van Hise will be 6,000 gross tons on 18 feet draught. She is 461 feet over all, 50 feet beam and 29½ feet depth. The Van Hise is built on the channel system plan, with deep floors and belts every 24 feet. She has a double bottom, 5 feet 6 inches, and is constructed of steel throughout. The propelling power consists of a quadruple expansion engine. Steam is generated by three Scotch boilers, each 12 feet 3 inches long with a mean diameter of 13 feet 4 inches and with a heating surface of 2,250 square feet. Diameters of the cylinders are 20½, 30, 43½ and 63 inches with a common stroke of 42 inches.

The steamer A. B. Wolvin, built for the American Steel & Wire Co. by the American Ship Building Co. at the old Globe ship yard, Cleveland, was launched last Saturday. The vessel was christened by Mrs. H. G. Dalton. The Wolvin is a steel steamer of the Welland canal size, being 242 feet over all, with 42 feet beam and 26½ feet molded depth. She will be equipped with triple expansion engines and Scotch boilers. Her carrying capacity is about 3,000 tons.

It is understood that President W. L. Brown of the American Ship Building Co., as well as General Manager James C. Wallace and Assistant General Manager W. E. Fitzgerald of the same company are all interested with Mr. A. B. Wolvin of Duluth in the steamship company that is building in lake yards four vessels of Canadian canal dimensions for lake and coast service. Mr. D. Sullivan of J. G. Keith & Co., Chicago, is also said to be a stockholder in the company.

The Japanese custom of releasing doves was again observed at the launching of the barge Bryn Mawr on Tuesday of this week. The barge was built by the Chicago Ship Building Co. for the Pittsburgh Steamship Co. (Carnegie) and is 414 feet length over all, 50 feet beam and 27 feet depth of hold. She will carry about 5,900 gross tons on a draught of 18 feet.

It is understood that Mr. J. A. Ubsdell, now assistant manager of the Chicago Ship Building Co., will succeed Mr. W. I. Babcock who retires from the management of the Chicago works on July 1.

## REPORT ON NAVAL CONSTRUCTION.

The monthly report of Rear Admiral Hichborn, chief of the navy bureau of construction, shows that two of the Denver class of cruisers have been laid down—the Cleveland at the Bath Iron Works, Bath, Me., being 3 per cent. completed, and the Chattanooga at the yard of Lewis Nixon, Elizabeth, N. J., being 2 per cent. completed. Progress of construction on other vessels is reported as follows:

Battleships—Illinois, building at Newport News, 81 per cent; Alabama, Cramp & Sons, 96; Wisconsin, Union Iron Works, 92; Maine, Cramp & Sons, 27; Missouri, Newport News, 4; Ohio, Union Iron Works, 19.

Monitors—Arkansas, Newport News, 31 per cent; Connecticut, Bath Iron Works, 52; Florida, Lewis Nixon, 36; Wyoming, Union Iron Works, 46.

Torpedo boat destroyers—Bainbridge, Neafie & Levy, 62 per cent; Barry, Neafie & Levy, 62; Chauncey, Neafie & Levy, 62; Dale, Wm. R. Trigg Co., 75; Decatur, Wm. R. Trigg Co., 74; Hopkins, Harlan & Hollingsworth, 57; Hull, Harlan & Hollingsworth, 57; Lawrence, Fore River Engine Co., 93; Macdonough, Fore River Engine Co., 91; Paul Jones, Union Iron Works, 73; Perry, Union Iron Works, 73; Preble, Union Iron Works, 72; Stewart, Gas Engine & Power Co., 25; Truxtun, Maryland Steel Co., 23; Whipple, Maryland Steel Co., 23; Worden, Maryland Steel Co., 23.

Torpedo boats—Stringham, Harlan & Hollingsworth, 98 per cent; Goldsborough, Wolff & Zwicker, 99; Bailey, Gas Engine & Power Co., 90; Bagley, Bath Iron Works, 50; Barney, Bath Iron Works, 71; Biddle, Bath Iron Works, 10; Blakely, Geo. Lawley & Son, 85; DeLong, Geo. Lawley & Son, 85; Nicholson, Lewis Nixon, 54; O'Brien, Lewis Nixon, 54; Shubrick, Wm. R. Trigg Co., 87; Stockton, Wm. R. Trigg Co., 91; Thornton, Wm. R. Trigg Co., 84; Tingey, Columbian Iron Works, 60; Wilkes, Gas Engine & Power Co., 45.

Submarine torpedo boat—Plunger, Wm. R. Trigg Co., 85 per cent.

## LARGEST SINGLE ARMOR PLATE.

The largest single armor plate ever made at either Bethlehem or Homestead was shipped on June 2 to San Francisco, to be used in the construction of the battleship Wisconsin, which is building there at the Union Iron Works. The plate will become the port plate of a turret on the vessel and is made on a new principle, being cut at an angle instead of being the arc of a circle. The idea is to better deflect a shot. The plate weighs thirty tons and costs over \$12,000. It was pressed at Bethlehem, as the armor press at Homestead was unequal to the job, and returned to Homestead for finishing.



## SHIP BUILDING IN GERMANY.

HOWALDTSWERKE, A GROWING AND PROGRESSIVE CONCERN—SOME FIFTEEN VESSELS OF 200 TO 11,000 TONS UNDER CONSTRUCTION.

BY GEORGE CROUSE COOK.

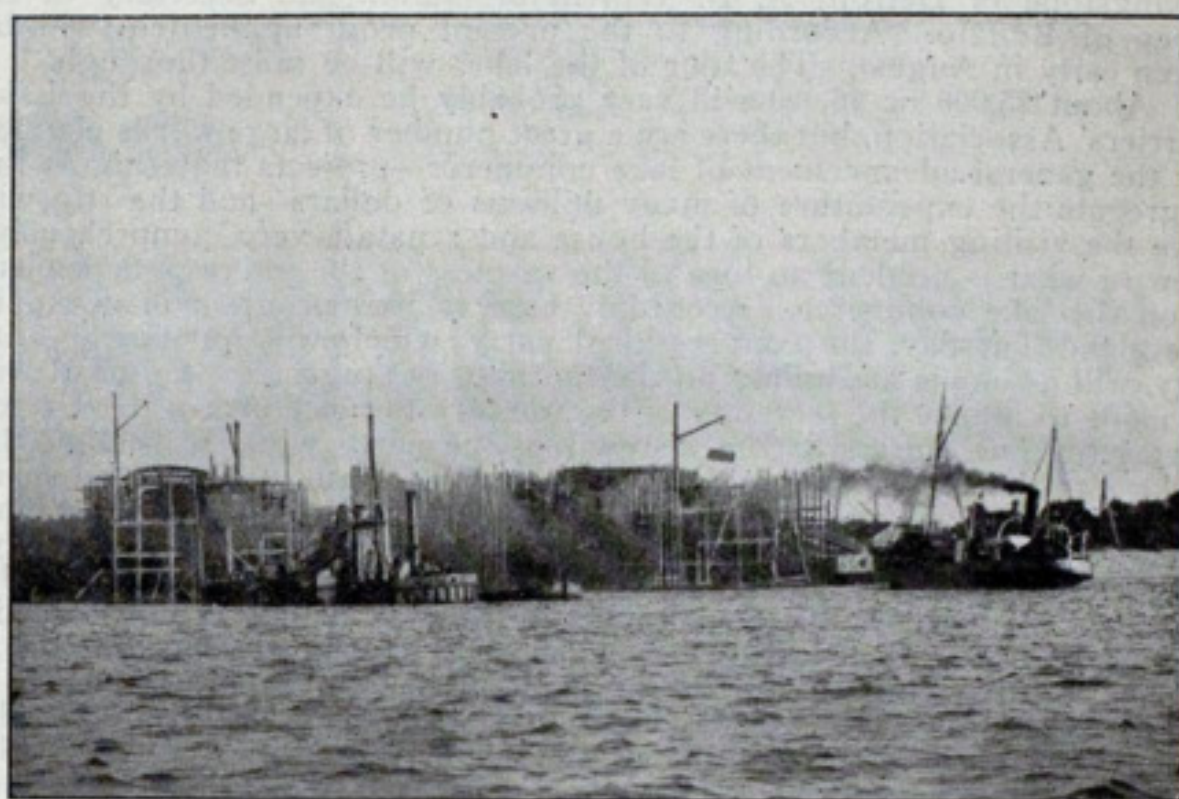
Readers of the Review will probably be interested in a brief description of some of the German ship yards which I promised to write when leaving America. I will not endeavor to cover more than one yard in any of these letters. The history of the present Howaldtswerke begins with the establishment at Kiel in 1838 of an engineering shop and foundry by a Mr. A. F. Howaldt, and which was continued by him in these branches till 1865, when, to have additional ground for the disposition of engines, facilities for the construction of iron ship hulls were added. In 1876 the sons of the elder Howaldt, who had become trained ship builders, established the Howaldts Brothers Ship Yard on the present site and worked in conjunction with their father till 1889, when the two united and formed a limited company for ship and engine building, the Howaldtswerke. There is also a small branch yard and floating dock for small work and repairs in Hungary on the Adriatic. The management of this company is in the hands of members of the Howaldt family, the present

house and lot at the end of a certain number of years' service, the rent he has paid during this service being placed to his credit for the ownership of the property.

The yard itself occupies the point of land at the junction of the Schwentine river and the Kiel bay, and contains 320,000 square meters. Every advantage has been taken of the natural fitness of the ground for the location of a ship yard. A series of five ways for small vessels are grouped on the river bank, and at right angles to these stand a series of four large ways, giving the width of the bay for the free launching of the largest vessels. This allows of an excellent arrangement of ship machinery sheds, of which there are two, one opening to each series of ways. The one serving the series of large ways, which was recently constructed, is a large steel frame structure with cement walls, fitted with conveniences for marking and handling material, and supplied with the largest and best ship machinery of Scotch and German manufacture. A number of pneumatic tools of American manufacture are also in use here. Then there is the shop serving the smaller ways, which is fitted with machinery of German and Scotch manufacture, and which is of itself sufficient to fit out a good sized yard. This is a complete independent plant which could handle almost anything in the way of overflow work that might be crowding the larger shop. Material, which is purchased both in England and Germany, reaches the company's piers by steamer directly from England



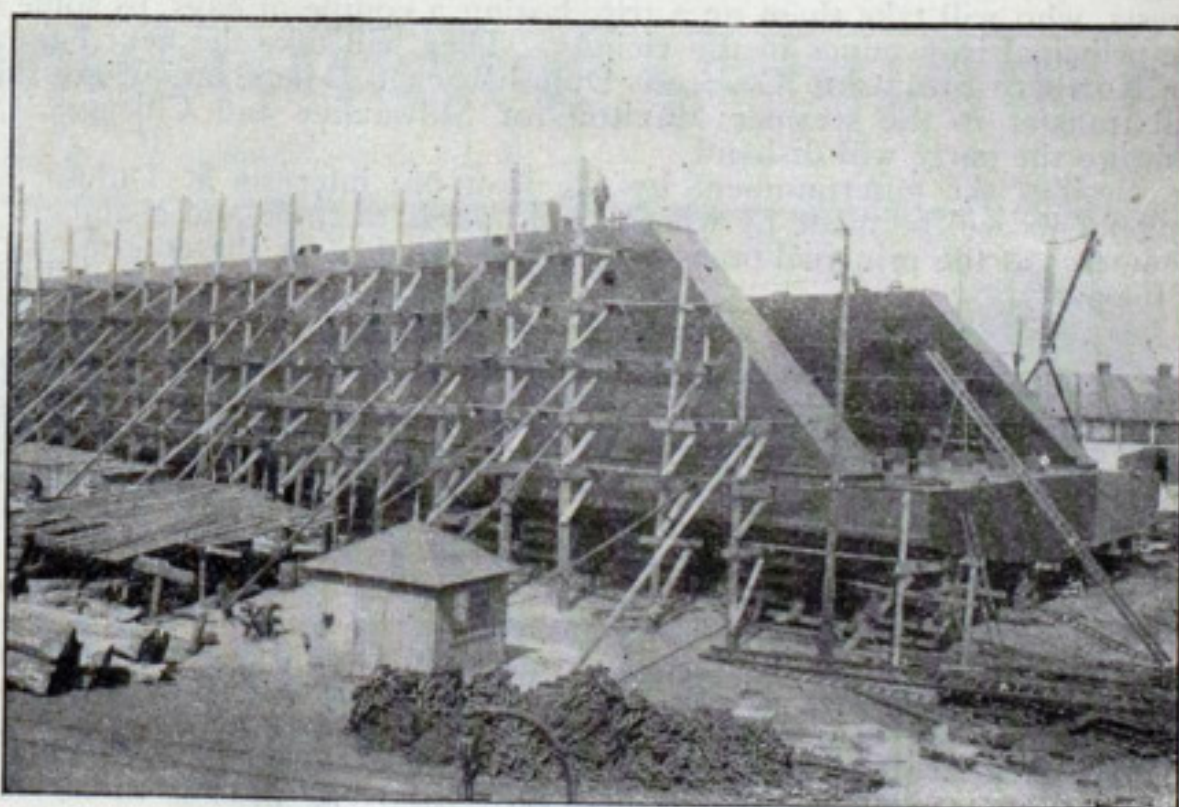
LAUNCHING WAYS ON THE KIEL BAY.



VIEW OF WORKS FROM THE KIEL BAY.



SHIP MACHINE SHED UNDER CONSTRUCTION.



BOLTED UP DRY DOCK FOR EAST AFRICA.

### Ship Building in Germany—Howaldtswerke at Kiel.

able ship building executive being a Mr. George Howaldt, a grandson of the original founder. The capital of the company now stands at 7,500,000 marks, 2,500,000 marks of which are as a 4½ per cent. mortgage.

The ship work now under construction embraces hulls No. 364 to No. 378, these numbers standing for vessels of 11,000 tons to 200 tons, and an even greater comparative range of types. Starting with an 11,000-ton trunk-deck freight steamer for the Swedish ore trade, the list goes through intermediate freight and passenger steamers, one of which is a screw steamer of 1,500 tons for the Cuban coasting trade. Then there is a heavy wooden ship, building for the German government antarctic exploration expedition in 1901, and a number of smaller vessels, tugs, pilot boats and ferries. Two dry docks are well under way, one of them being merely fitted and bolted up, to be taken down later, boxed and shipped to the German colonies in East Africa. The list includes also two dredges of the Vernandow patent type for the Russian government. There is, of course, a great deal of general repair work going on all the time.

The facilities of the Howaldtswerke for handling this enormous amount of work are exceptional. The drawing office is large, well-lighted and well-ventilated, and supplied with all modern instruments for calculation and design. There is also a well-stocked library of reference books and marine publications of German, English and French edition; this with a designing staff whose leaders are workers and believers in Germany as a ship building country. The men in the yard are mostly Germans with a few Swedes and Norwegians. Messrs. Howaldt endeavor to obtain and hold steadily a high class of workmen in the yard, and to this end they have a "workman's colony," where a man acquires a good

or by German barges, and is moved about the yard by the conventional motor cranes. It is put on the ship by pole derricks driven by electric winches.

A special designing staff is also employed, and special tools used for the construction of floating docks which are a specialty with the Howaldtswerke. In this particular line they are the successful rivals of British builders and have won many competitive contracts.

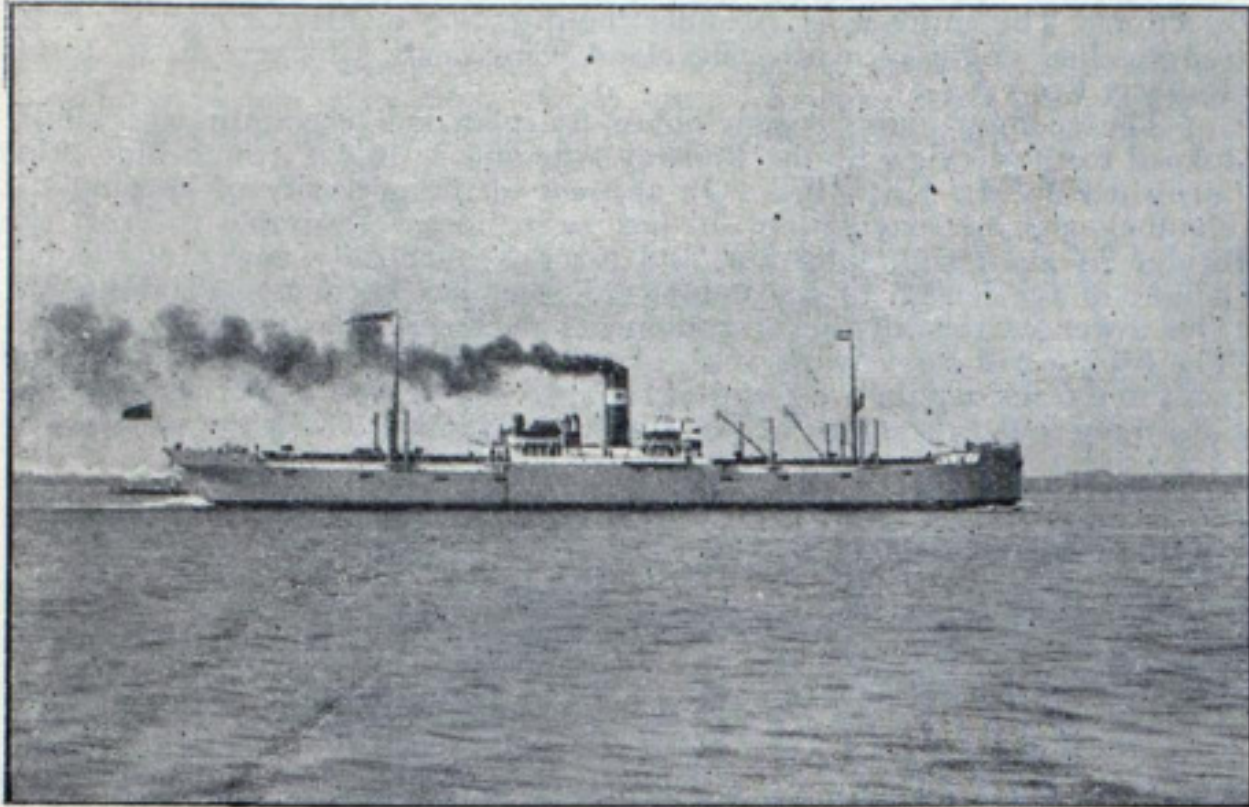
The Howaldtswerke is, of course, its own engine and boiler builder. Shops for this purpose are large, well arranged and fitted with electric, pneumatic and steam-powered machinery of German and American manufacture. The tools of the boiler shop are mostly hydraulic with an excellent overhead electric traveling crane. There is a foundry capable of making the largest iron castings, and a Siemens-Martin process furnace. Much outside work is done in the foundry line. The smith shop has the Buffalo down-draft forges. In fact there are provisions for working up every detail of a ship or engine. This condition is due in part to the isolated and therefore self dependent position of Kiel and the ship yard, but more particularly to the enterprise of the company's executive.

Two floating docks of the Howaldt composite type of 1,300 and 1,700 tons lifting power are connected with the works, and rest in the river where it joins the bay.

The future policy of the works is that of expansion in its broadest sense. Energy and enterprise are shown in all its affairs. Plans for three new ways for launching into the bay the largest types of ships are completed, and an additional floating dock of three sections to carry



11,000 tons dead weight is being designed. Specifications for a 150-ton electric crane, to stand on the sea wall, are completed and the joiner shop and sawmills are being enlarged. The office has been increased recently by the addition of another story, and there is nothing being overlooked that can add to the efficiency of the works. It is the ambition of the



OSCAR FREDERICK, 11,000-TON TRUNK-DECK FREIGHT STEAMER, BUILT BY THE HOWALDTSWERKE, KIEL, GERMANY.

Howaldts to become leaders in German naval construction as well as in the merchant line, so they are giving every effort to increase the facilities of the yard and promote the quality of their work by finding the latest and most effective tools and machinery.

#### BUILDERS' TRIP OF THE VARIAG.

The recent builders' trial trip of the Russian cruiser Variag, built at the Cramp works, Philadelphia, was exhaustive in every way, but the vessel seems to have stood the test. On the speed trial the cruiser developed a speed of 22 knots an hour under natural draft and with one of her boilers out of use. The contract calls for a speed of 23 knots an hour, and while that speed was not attained it is confidently expected that the cruiser can cover 24 knots an hour when placed under forced draft. In a 24-hour run she maintained a steady 21-knot speed. Special interest centers in the boilers of the vessel, which are of the Niclausse water tubular type, made by the Sterling Co. of Chicago. She has the largest installation of water tube boilers in the world, there being thirty boilers with 9,240 tubes, giving a heating surface of 55,000 square feet. The work done by these boilers was fully up to the expectation of the builders. The Variag was also severely tested as to her construction by the firing of every gun on the ship. The Russian officers claim that she has as heavy a battery as any warship of her type afloat. The twelve 6-inch guns were fired in all directions singly and in pairs while the 75-mm. guns of the port side, four in number, were fired simultaneously. The ship stood the strain well. The official trial trip will occur in July.

#### TORPEDO BOAT DUPONT DAMAGED.

The torpedo boat Dupont was seriously damaged last week while being docked at the torpedo station at Newport, R. I., and as a result will have to be provided with a new bow. Under the command of Lieut. F. H. Brown, she had been to Providence with members of the torpedo class, and, returning, was running into her slip at the station. These boats can be reversed so quickly that they run almost full speed right into the slip. This was done with serious results. The signal was given to stop and reverse but in some way the engine did not respond, something jamming, and she plunged into the wharf, crushing her bow in nearly 6 feet. Watertight compartments prevented her from sinking. She will be sent to Bristol for the Herreshoffs to give her a new bow. It is understood that no blame can be attached to those in charge.

#### HOBSON IS NOT WELL.

A cablegram was received at the navy department last week from Admiral Remey, commanding the Asiatic station, announcing that a medical survey board had reported Naval Constructor Richmond P. Hobson unfit for active service, and recommended that he be detached from service at Cavite and ordered home. No previous intimation had been received that Mr. Hobson was in ill-health and the announcement that he had been condemned physically caused much surprise. Acting on the cablegram, the department assigned Naval Constructor Thomas F. Ruhm as Hobson's successor. It is not believed that his condition is such as to cause his retirement from active service, but that after a rest he will be again fully restored to his former vigorous health.

#### COMMANDER TODD RESTORED TO DUTY.

Commander Chapman C. Todd, chief hydrographer, who was suspended from duty by the secretary of the navy last month on charges growing out of the controversy in the house of representatives concerning surveying work by the navy, was restored to duty last week by acting Secretary Hackett. Commander Todd was suspended, while chief hydrographer, for writing letters to naval officers in charge of branch hydrographic offices to use their influence to counteract the attempt of the house committee on appropriations to cut down the appropriations for ocean and lake surveys by the navy.

The secretary of war has awarded the contract for the reconstruction of the transport Kilpatrick to the John N. Robbins Co. of Brooklyn, N. Y., at its bid of \$408,000, which was the lowest one received. The Kilpatrick is to be fitted out for service between this country and the Philippines.

#### A TALK WITH HICHBORN.

FEATURES OF THE NEW BATTLESHIPS THINKS IMPROVED 10-INCH GUNS WILL BE THE HEAVIEST OF THE FUTURE—FAVORS SOME NEW WORK IN NAVY YARDS SO AS TO KEEP UP WORKING FORCE.

Rear Admiral Philip Hichborn, chief constructor of the navy, was born at Charlestown, Mass., but he lived for a number of years on the Pacific coast and is much attached to it. His present visit to the Pacific coast is the first which he has made there in thirty years. He has been most hospitably received there. Discussing naval matters with a representative of the San Francisco Call he said:

"Since we have entered upon the new era of naval construction over 300 war vessels have been added to our navy, of which 200 were designed and built by the navy department, and the remainder, principally auxiliary vessels, added through purchase. I have been personally connected with the designing of every ship in the new navy and with those under construction and contemplated. We have now about sixty new vessels under construction, varying in size from a battleship of 14,000 tons to the smallest torpedo boats. The new naval bill calls for the construction of three new battleships of the Pennsylvania class, which will be above 15,000 tons each, have a speed of 19 knots and will be the largest and most powerful battleships afloat. They are to be fitted out with the latest electrical appliances for auxiliary power—machinery that now seems well nigh perfect—and will carry 12-inch guns of the most improved pattern. So successful have the trials of the Holland submarine boat been that the bill also calls for the construction of five more submarine boats of an improved type. This number does not include the Plunger which is already under way. The work now being done will require probably three years to complete, although many of the vessels will be finished in much less time. Just at present the ship yards have all they can do.

"The progress of the age has been wonderful. When I entered the Mare island navy yard in 1861 we were building wooden ships. The transition from wood to iron and iron to steel has been so rapid that it almost passes comprehension. From auxiliary steam and sail power we have passed to full steam power, and almost mastless vessels, and now electricity has entered the field and made the most wonderful change of all. We have the most powerful engines of war afloat that the mind of man can design, but we still know but little of the actual value of modern arms and heavy guns. The late war taught us little, because there was not at any time a standing fight between two steel vessels. Such a battle would be short but decisive.

"The chief characteristic of the battleships now under construction will be the wonderful electric appliances used in giving them auxiliary power. Here you are building the Wisconsin and Ohio, and in the East the Illinois, Maine, Alabama and Missouri. They have inclining turrets, so evenly balanced that no matter what the position of the vessel they can be handled with equal facility. By means of electrical appliances these turrets, containing guns that weigh from 400 to 500 tons, can be moved with great rapidity. By a slight movement of the hand the ponderous turret can be swung on a circle with an arc of 360 degrees in one minute, and stopped at any time on a hair line without any damage whatever to the machinery. The power is even at all times, no matter what the position of the ship. Tests have proved that a single heavy shot landed on the turret at close range will not disturb the machinery; and it is not probable that more than one shot will be landed in the same place during a battle, for the experts tell us that in a radius of one mile the chance of one ship hitting another is about one in twenty.

"Another improvement in the new battleships is the elimination of the 13-inch gun and the substitution of the 12-inch, which is easier handled, longer lived and less costly in firing, and yet quite as effective. It costs \$550 each time a 13-inch gun is discharged. I am of the opinion that the caliber of the guns will still be greatly reduced, and that in ten years improved 10-inch guns will be the heaviest used in the navy. They can be handled with greater facility, fired more rapidly and made just as effective. Experience has proved that rapid-fire guns are the most effective. Marksmanship will be an important factor in naval battles. Every vessel must have some vital spots. Light, rapid-fire guns can be so handled that these spots can be reached more easily. When a ship's vitals are pierced she can be no longer in the fight.

"I am in favor of building ships in our own navy yards, not to the exclusion of other ship building yards, but to give steady employment to our workmen, and thereby secure a force of men who will be reliable and valuable. The repair work in our navy has become an important matter. When a vessel ends a cruise she needs repairs, and the work must be done properly. That means a large force of men. My idea would be to commence the construction of a war ship at each navy yard, calculating that it would require four or five years to complete the work. When a vessel comes in from sea and needs repairs put the entire force at work on it and finish up the job. When the work is done let the men return to the construction of the new ship. In that way we shall always keep men and materials available for any emergency."

#### NAVAL VESSEL COMPARISONS.

A fine appeal was made to the imagination last week when the new battleship Kearsarge left Hampton Roads for New York, and her place was taken the next day by the old Hartford, which had just arrived from her long voyage from San Francisco. The voyage of the Hartford was in itself a notable performance. It was made by that ship over the same course that was pursued two years ago by the Oregon in perhaps, all things considered, the most wonderful voyage ever made by a ship of war. Time was when the Hartford was as conspicuous and important in the American navy as was the Oregon two years ago. Now she is a relic of the past, despite her much remodelling. One day, no doubt, the splendid Oregon will be as obsolete as the Hartford is now. In fact, there are those who begin to regard her as already surpassed by the new Kearsarge, and certainly by the still newer monsters that are yet in the ship yards. But remembering the Hartford as what she was on that August morning in Mobile bay, and the Oregon as what she was in that world-startling run on that summer Sunday at Santiago, the contrast between them overwhelms calculation, while the thought that the change between them has been effected within a single human lifetime is an amazing gauge of the world's inventive progress.—New York Tribune.



### ANOTHER LIFT BRIDGE.

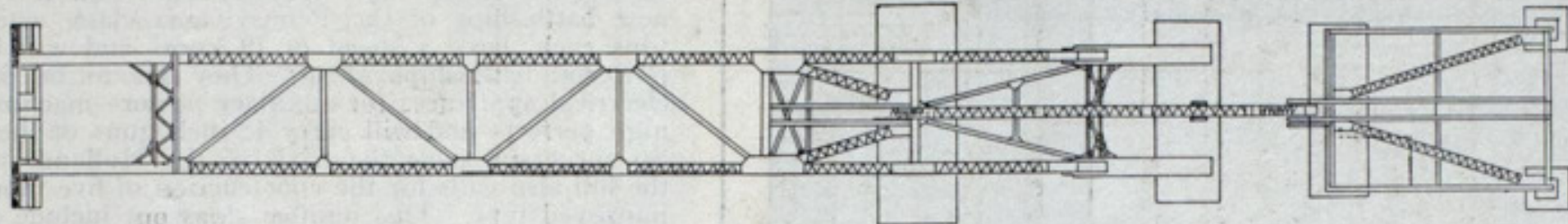
ONE OF THE SCHERZER TYPE IS BEING BUILT BY THE BIG FOUR RAILWAY IN CLEVELAND—ADVANTAGES OF THE NEW DESIGN.

There is now under construction by the Cleveland, Cincinnati, Chicago & St. Louis Railway Co. (Big Four system) at Cleveland a rolling lift drawbridge over the Cuyahoga river to replace an old wooden swing span leading to the industries on the flats. The bridge is in plain view from the Superior street viaduct. The conditions of narrow right-of-way, valuable dock space and large clear channel required, made it necessary to adopt some other than a swing bridge. The advantages of the new design are many. It costs considerably less than a swing bridge, it takes up less room, it affords the same clear channel and requires only a partial opening for small craft. The bridge is a Scherzer rolling lift bridge of the single-arm type, having a clear channel opening of 110 feet and a main span of 125 feet, center to center of piers. The length over all is 212 feet 9 inches. The moving span revolves through a vertical angle of 83 de-

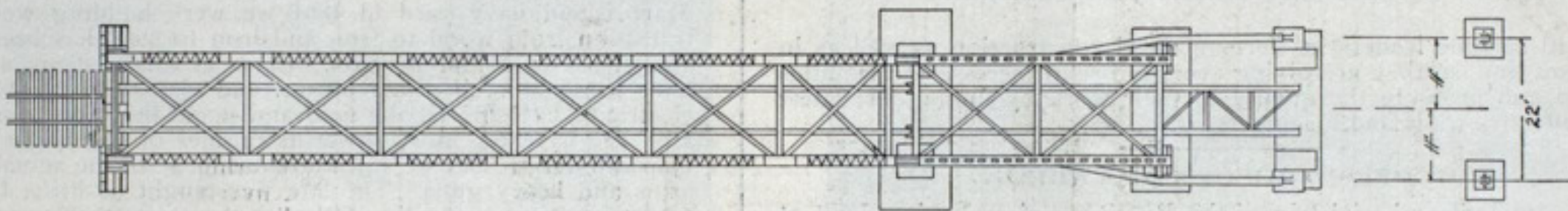
was accomplished with a slight change in the floor system by simply raising the east abutment the required amount and allowing the bridge in closing to come down only to the grade line instead of to a level.

The superstructure was designed by the Scherzer Rolling Lift Bridge Co. of Chicago under their patents. The Pennsylvania Steel Co., of Steelton, Pa., has the contract for the superstructure, including machinery and erection. The entire work is under the direction of Mr. George W. Kittredge, chief engineer of the Cleveland, Cincinnati, Chicago & St. Louis Railway Co.

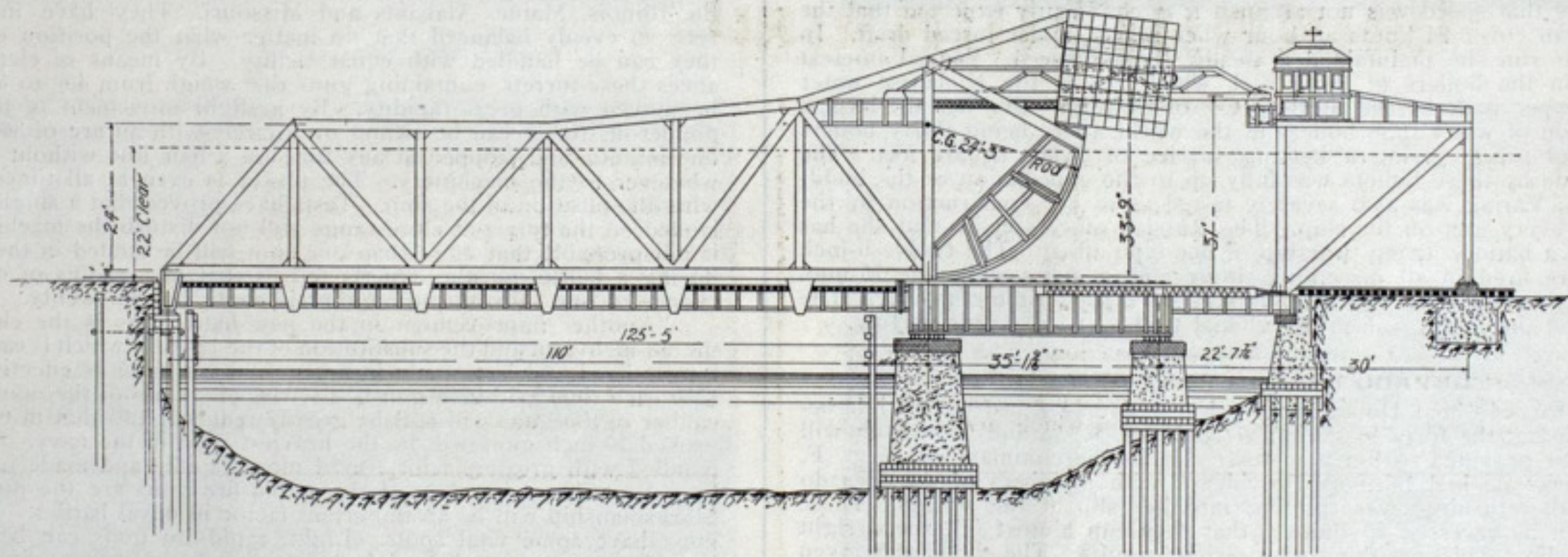
The accompanying engraving of the plan and elevation was kindly loaned to the Review by the Railway Age and is drawn from a blue print furnished by Mr. Kittredge. On account of the necessity of keeping the channel open for navigation, it has been found desirable to erect the bridge in an upright position, and for this purpose a tower of the full height of the length of the completed span has been erected alongside. The tower carries all the arrangements necessary for hoisting material. The bridge will carry two tracks, placed gauntlet fashion, and connecting with five tracks at the west end of the lift. These five tracks also diverge into numerous others just across the street, against which the west portal



PLAN OF TOP LATERALS & MACHINERY SUPPORTS.



PLAN OF BOTTOM LATERALS & FLOOR SYSTEM.



PLAN AND ELEVATION OF NEW LIFT BRIDGE AT CLEVELAND—BIG FOUR RAILWAY.

grees. The main span is a single track through riveted truss and the flanking spans are deck plate girders.

The rolling load used in designing the superstructure was 4,000 pounds per lineal foot of track, with a single excess of 50,000 pounds, placed at the most effective point. The piers and west abutment are of concrete masonry with Berea stone copings on a foundation of piles and grillage. The east abutment has been built of piles and timber, on account of the extreme difficulty of putting masonry at that point without interfering with navigation. The position of the counterbalance weights and the radius of the rolling segment are so arranged that the line of travel of the center of gravity of the whole rolling system is horizontal. The operating machinery has, therefore, only the resistance of friction and wind to overcome.

The operating strut is a riveted lattice girder 63 feet long, connected by a 6-inch pin at one end to the rolling span at a point just above and beyond the center of gravity, and having on its under side cast-steel rack segments, with teeth of 5-inch pitch and 16 inches width of face, which engage with a pinion on the operating machinery. The operating strut is also equipped with guide rollers, which roll on top of the guide girders, whose top is so covered as to keep the rack teeth at all times engaged with the pinion. The bridge will be operated by the engines from the old swing bridge, but the gearing is also arranged so that electric power may be substituted in the future.

The tops of the heavy girders, which carry the rolling segment, are provided with steel trackplates, having teeth 5 inches wide, 12 inches long and 2 inches high, at intervals of 2 feet 7 inches, which engage with corresponding openings in the trackplate on the rolling segment, serving to keep the bridge in line while being opened or closed, and resisting the movement of the wind on the long arm. The counterbalances (one for each truss) are made up of cast-iron blocks 2 feet square, bolted to a riveted framework.

During the progress of construction it was found desirable to make the grade across the bridge .5 per cent. ascending instead of level. This

abuts. The track arrangement is thus a somewhat complicated one, and in itself suggests the desirability of a bridge capable of being raised and lowered in the shortest possible time, in order not to interfere with navigation or railway service.

### BUSY SOUTHERN SHIP BUILDING PLANT.

One of the busiest places in Jacksonville is the works of the Merrill-Stevens Engineering Co. Contracts on hand at present are sufficient to keep the entire force employed during the summer and well into the winter. The company is at present overhauling the ferry boat Commodore Barney. The woodwork will be gone over as well as the machinery and boilers. In the boilermaking department a boiler of 350 horse power is being built for the steamer Crescent City of Apalachicola; also a boiler of 300 horse power for the tug Biscayne. Boilers of small power are being built for the steamer Pioneer, the Palatka and the Susie May. The company has just secured a contract for giving the iron hull tug Iris of Brunswick, Ga., a general overhauling, including new boiler and wheel and repairs to machinery.

Sealed proposals will be received at the office of the light-house board until 2 o'clock p. m., July 6, and then opened, for furnishing the materials and labor of all kinds necessary for the construction and delivery of the steel steam light-house tender Heather, delivered at the buoy depot at Astoria, Ore.

The Nickel Plate road offers low rates to Des Moines, Ia., account annual convention Music Teachers' Association. Tickets good going June 17 to 21 inclusive, and good returning not later than June 23, 1900, at one fare for the round trip. Write, wire, 'phone or call on E. A. Akers, C. P. & T. A., Cleveland, O., or C. A. Asterlin, T. P. A., Ft. Wayne, Ind.

83 June 14.



## NEW ORE DOCK AT WEST SUPERIOR, WIS.

The new ore dock of the Eastern Railway of Minnesota (Great Northern system) at Allouez Bay, West Superior, Wis., is completed. The new dock is reached by a double track approach, from the left hand track of which an approach 1,600 feet long gives access to the old dock. The most notable features of the new dock are as follows: The deck of the structure is 73 feet 1 inch above the mean stage of the water, the hinge of the spout being about 40 feet above the water. It is 1,500 feet in length, 65 feet wide from out to out of galleys posts, and contains 250 ore pockets, each of which is 11 feet wide, 25 feet long on top and

all of which tends to reduce the cost of handling the ore. The plans for the structure were prepared in the office of the chief engineer of the road at St. Paul under the direction of the principal assistant engineer.

## LIDGERWOOD CABLEWAY.

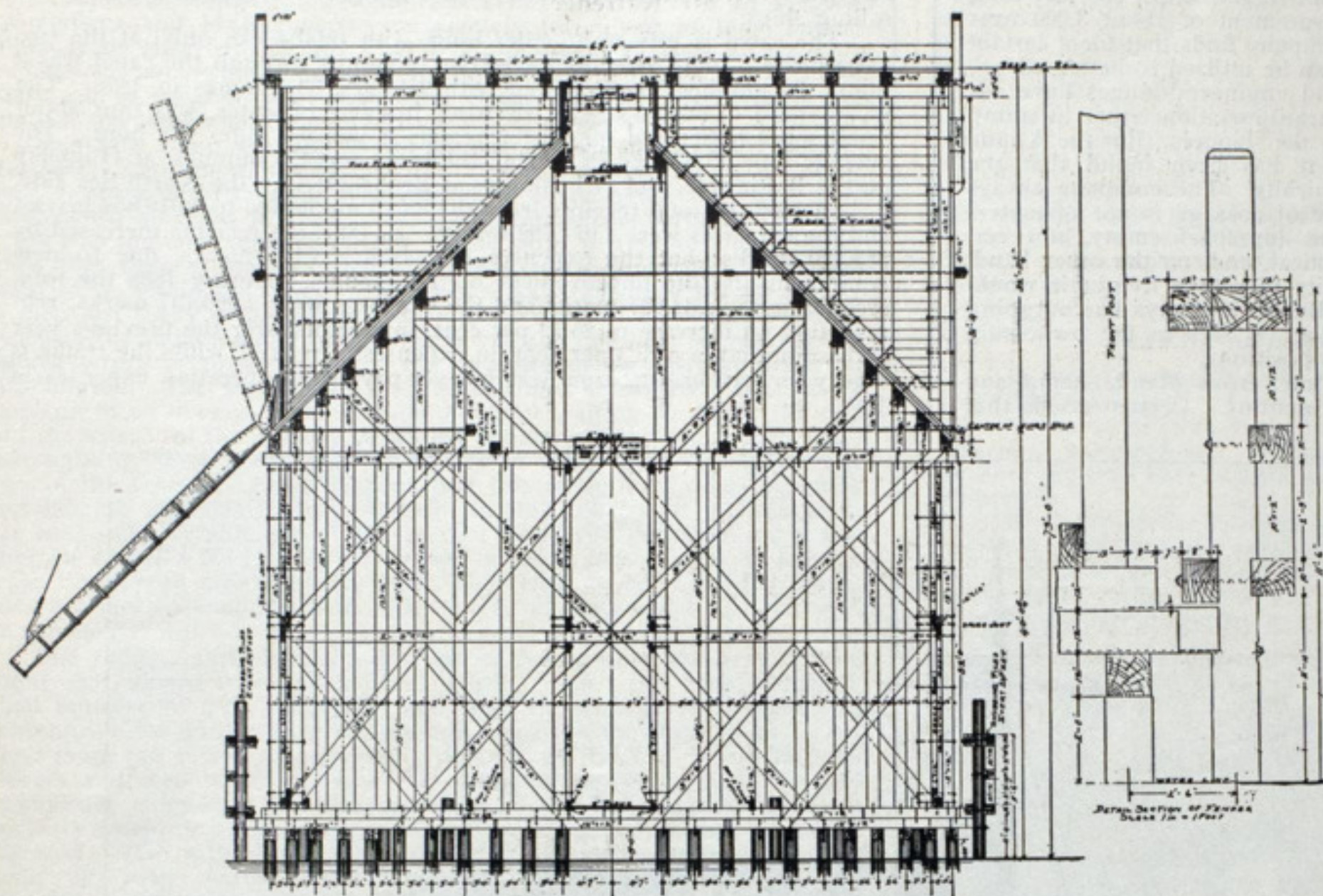
The Lidgerwood Mfg. Co., 96 Liberty street, New York, has issued for free distribution a book on "The Lidgerwood Cableway" which will be studied with interest by every engineer and contractor having to do with the hoisting and conveying of materials of all kinds in the most economical and expeditious manner. The book contains about 200 pages which are profusely illustrated with half-tones and pen sketches of the cableway as employed in the construction of dry docks, dams, piers, walls, fortifications, etc., and for open-pit mining, quarrying, logging, discharging vessels and transferring cargo between ships at sea.

A splendid view of a battery of Lidgerwood cableways as used on the Chicago drainage canal forms the frontispiece of the book. This is followed by an example of the use of the traveling cableway in constructing a dry dock at the works of the Newport News Ship Building & Dry Dock Co. Considerable space is given to the Lidgerwood cableway on United States government fortifications, notably at Gerrish Island, Me., where the cableway is used as a high-speed, long-reach, traveling crane; also at Fort Morgan, Mobile, Ala., Fort Pickens, Fla., Willets Point, N. Y., Fishers Island, N. Y., and Tybee Island, Ga. On some of this work a new type of radial traveling cableway was employed, wherein the head tower is arranged to travel about the other, thus covering a wide area for excavating and delivering concrete and other material directly to any part of the work.

A chapter is devoted to "The Lidgerwood Cableway on the High Seas," in which is presented various views and a complete description of the Miller conveyor for coaling vessels at sea, recently tested and accepted by the United States navy department, and which has already received much attention from the technical and daily press. Views are also published of the traveling dock cable-

way with overhanging boom for discharging coal from vessels as well as for reloading barges and boats. The subject of canal and dam building is considered at some length and several important plants are shown and described, notably a curved masonry dam in the consolidated gold fields, Johannesburg, South Africa; new Croton dam, New York; the Austin dam, Austin, Texas, etc. The work of the Lidgerwood traveling cableways and other appliances on the Chicago drainage canal is presented in the records of the building of this greatest of American canals, which give full particulars and complete data.

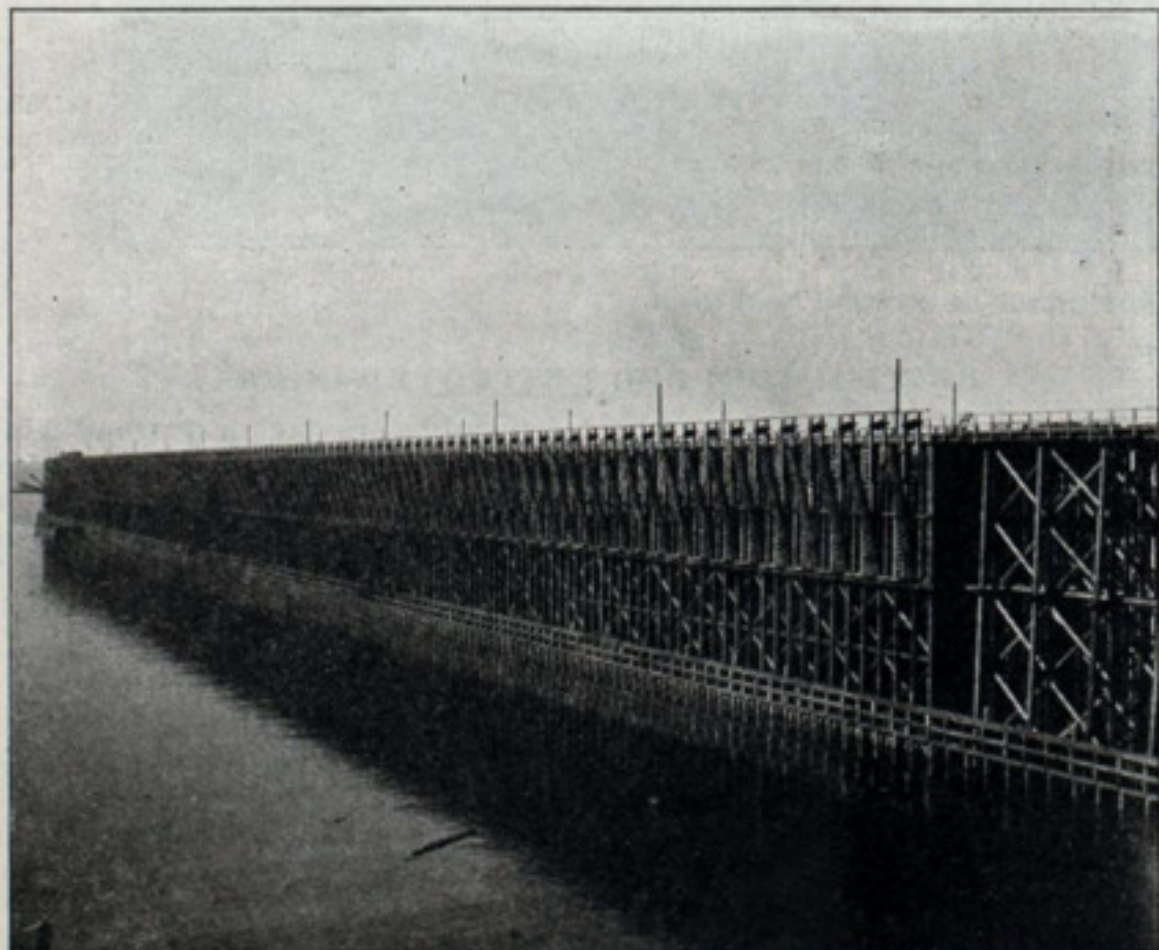
"Dredging by Cableways" shows the Lidgerwood apparatus as employed in finishing and cleaning out the great Mexican drainage canal, near the city of Mexico, using the Hayward self-filling bucket, which is



CROSS-SECTION OF NEW ORE DOCK, ALLOUEZ BAY, WIS.

32 feet deep at the face of the dock, with a floor inclined at an angle of 45 degrees, 37 feet long, constructed of surfaced hard maple. Each pocket is estimated to have a capacity of 260 tons of ore, making the total capacity of the dock about 65,000 tons, which under ordinary conditions can easily be unloaded into vessels in thirty-six hours. Each pocket has four tracks passing over it with an opening under each track through which the ore is dumped. The dock and approaches are supported by 13,216 piles, averaging anywhere from 40 to 60 feet in length, and required about 12,000,000 feet B. M. of timber for their construction. The double track main approach is 4,600 feet in length and on a grade of .72 per 100 feet.

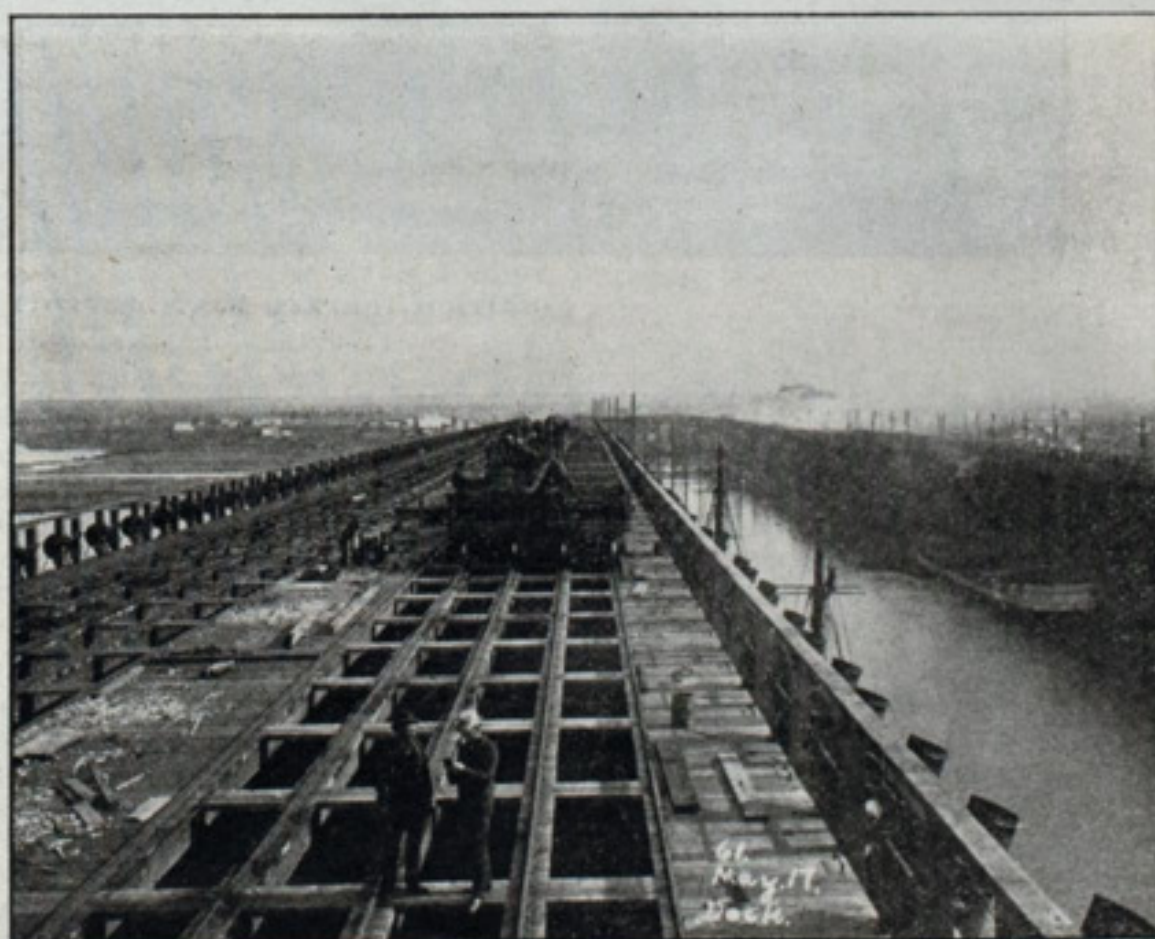
A fender has been constructed, which, contrary to general practice, is entirely independent of the dock proper, and which under the most



NEW ORE DOCK AT WEST SUPERIOR, WIS.

severe pressure will not transmit any shock to the structure. It is constructed in the ordinary manner except that between each bent supporting the dock are driven three brace piles, connected to the fender by struts and rods in such a manner as to take up all of the strain brought to bear upon it without in any way interfering with the dock.

Apart from an unusually substantial construction, the dock is a radical departure from the general practice to the extent of its increased height, width and capacity. The advantages claimed for it are: Being able to load vessels quickly, a largely increased storage capacity for the same length of dock and a greater facility in unloading ore from cars,



NEW ORE DOCK AT WEST SUPERIOR, WIS.

especially well adapted for this work. "Placer Mining by Means of the Cableway," with self-filling drag bucket, describes very thoroughly and attractively a plant furnished by the company to the German Bar Mining Co., Virginia City, Mont., which employs a Lidgerwood cableway of the radial type. The patented drag bucket is of novel construction and is claimed to be absolutely the highest development in its line.

Other chapters are devoted to the cableway for digging sand and gravel, for building bridges and piers, for handling pipe, quarrying, open-pit mining, coal stripping, etc., showing several important plants. The volume is a creditable piece of work throughout.



**SAILING SHIPS FOR STANDARD OIL CO.**

Friends of the sailing ship have found encouragement for the future of sailing vessels in the ocean carrying trade in the announcement that the Standard Oil Co., is building ships with sails instead of steamships for a part of its freight business. The company is building two ships here and the European branch is building two in Europe. At times the Standard buys ships, but it is not in the market to acquire a fleet, as has been erroneously reported. It owns about a dozen sailing ships now and is building these four others; that is all.

The two vessels building in this country are being built at Bath, Me., by Arthur Sewall & Co. They are to be full-rigged ships, 330 feet long and of 45 feet beam, and will have a measurement of about 3,300 tons gross. They are being built because the company finds that for a certain part of its carrying trade the sailing ships can be utilized to better advantage than steam vessels. Prices of coal and engineers' wages have advanced in recent years, raising the cost of transportation either in tramp steamers or steamers owned and operated by the shippers. For the Asiatic trade of the Standard Oil Co. in case oil it has been found that the sailing ships can be operated more economically. The company always has freight outgoing for them and the time of passage is not of material moment. Had the company to bring the ships back empty, however, the operation of them would not be economical, and, on the other hand, was it dependent wholly upon the possibility of return freight it would probably not feel like building the ships. But as it always has outgoing freight and frequently can get return cargoes, it sees in the ownership of its own sailing ships a good business proposition.

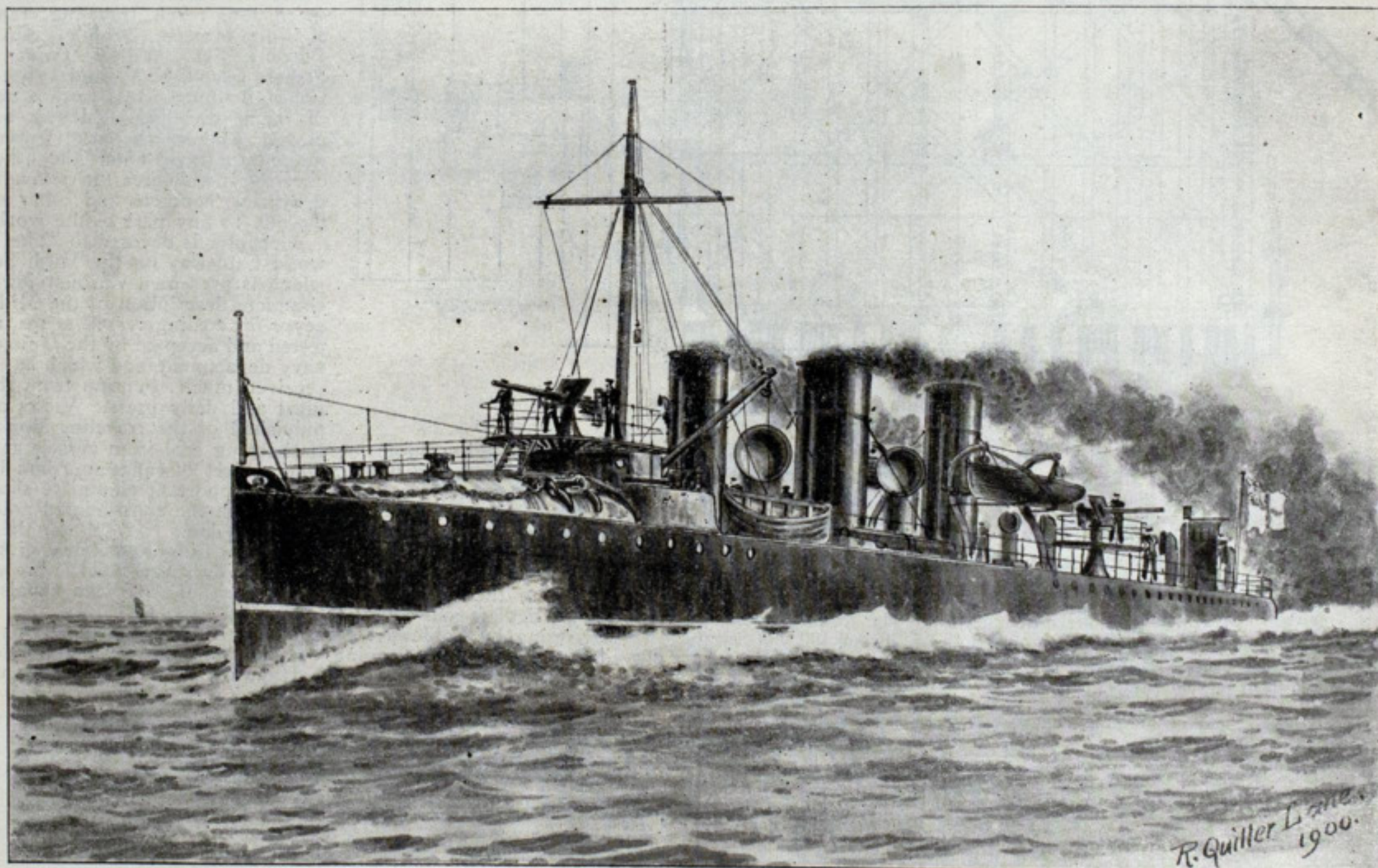
The ships bring back from Calcutta jute, from Manila hemp and sugar, and from other ports sugar, tea and matting. Certain goods that

**TRAFFIC OF KIEL SHIP CANAL.**

Late official reports give considerable detail touching the development of traffic on the North Sea and Baltic, or Kiel ship-canal. Two tables show the number of ships passing through the canal in the years 1895, 1896, 1897 and 1898, and their respective tonnage and means of propulsion. The number of vessels using the canal in 1895 was 16,834, divided into 7,531 steamships and 9,303 sailing vessels. In 1898 the total had increased to 25,816 vessels, with 11,005 propelled by steam, and 14,811 by sails. In 1896 the total tonnage was 1,848,585 tons, of which 1,407,435 tons was steam and 441,023 tons sailing vessels. In 1898 the total tonnage was 3,117,840 tons, of which 2,467,839 tons represented steam and 650,001 tons sailing ships.

The canal is fifty-eight miles long, with tidal locks only, at the two extremities. In 1897 the average time of transit through the canal was 8 hours, 30 minutes, as compared with 9 hours, 33 minutes in 1896. The mean speed of steam vessels, drawing 16.4 feet of water, was thus about 8 miles per hour; and for larger vessels it was 6.9 miles per hour. The average time consumed in passing the locks was 8.8 minutes, at Holtenau on the Baltic side, and 17.1 minutes at Brunsbüttel on the North Sea side.

In 1896 the total receipts from the canal amounted to 1,016,854 marks, and the expenses were 2,074,792 marks. In 1897, the receipts increased by 283,490 marks; but the expenses increased 203,490 marks, due to new equipment and the improvement of the channel. During 1898 the total receipts were 1,634,337 marks and the expenses were 2,066,737 marks, representing an increase of 25.72 per cent. in receipts over the previous year and a diminution of 9.3 per cent. in expenses. In brief, while the traffic is slowly increasing, the canal was not yet paying its operating expenses in 1898.



BRITISH TORPEDO BOAT DESTROYER COBRA—PROPELLED BY STEAM TURBINES.

must be here for certain seasons of course have to be shipped by steam vessels, but many staples can as well be shipped by sail and have the advantage of the lesser cost of transportation. It has been said that the sailing ships can carry freight 16,000 miles for \$5 a ton, cubic measurement, and make money, a price at which steamships could not operate. All of the Standard company's ships sail from the Atlantic seaboard and return here, as all the oil is on this side of the continent. The route is around the Cape of Good Hope.

**HOLLAND-AMERICAN STEAMER POTSDAM**

The new Holland-American steamer Potsdam arrived at New York May 28 from Rotterdam and Boulogne after a passage of nearly ten days. The Potsdam is a twin-screw passenger steamer, built by Blohm & Voss, of Hamburg. Her length is 565 feet, width 62 feet, and depth 46 feet. Her gross tonnage is 13,000. On the passage the Potsdam experienced considerable heavy westerly and northwesterly gales, with heavy head seas; therefore the engines were not forced. Captain Boujer says the steamer will make about 15 knots or better, and is expected to cover the distance between New York and Boulogne in nine days. The Potsdam has accommodations for 300 saloon, 250 second-cabin and 1,600 steerage passengers. She is built of steel and is fitted with bilge keels, which have made her an excellent seaboat.

The Barschall Impregnating Co. of No. 31 Nassau street, New York, has just issued an artistic little book entitled "A Treatise on Wood Preservation," embracing investigations by eminent German scientists and authorities on this subject. The investigation has special reference to a new German process—Hasselmann patents—that is said to be thorough, reliable and permanent.

**BRITISH TORPEDO DESTROYER COBRA.**

The new British torpedo destroyer Cobra, of steam turbine kind, which has just been completed on the Tyne, has, according to advices from London, beaten the Viper's record, making 35.886 knots per hour. No further information regarding the trip of the Cobra is at present obtainable. The dimensions of the Cobra are: Length 323 feet; beam 20 feet 6 inches; depth 13 feet 6 inches; four Yarrow water tube boilers. The vessel maintained a mean rate of 34 knots for six hours.

**HAVANA DRY DOCK.**

The Spanish government has consented to sell to the navy department the floating steel dry dock at Havana for \$250,000. It will cost \$25,000 to transfer the dock to another point, which will be necessary in case of purchase. Congress has made provision for the purchase and transfer by an item in the appropriation bill, \$275,000 in amount. There will be an examination of the dock before it is acquired to ascertain whether the sections have corroded or whether the structure has deteriorated in any way. If such be the case it will not of course be purchased. The new location for the dock has not yet been decided.

The Elizabeth Herald of Elizabeth, Pa., has issued a boat building centennial edition in connection with the regular issue of the paper. It is well illustrated throughout with etchings and half-tones and contains much interesting local history. It gives an account of the building and first voyage of the first ship built west of the Allegheny mountains and also a complete history of the industry of steamboat building at Elizabeth. Altogether it is quite a commendable undertaking for the Elizabeth Herald.



## QUICK MOBILIZATION OF A SQUADRON.

HOW THE BATTLESHIPS INDIANA AND MASSACHUSETTS WERE HASTILY PREPARED FOR A TWO-MONTHS' CRUISE.

Just before 4 o'clock on Tuesday afternoon of last week Secretary Long issued orders assigning the Indiana and Massachusetts to the North Atlantic squadron and directing that they proceed to Newport with as little delay as possible. The bureau of navigation issued the following explanation of the emergency order:

"The commandant at League island has been ordered to prepare the Indiana and Massachusetts immediately for a two months' cruise. When ready they will fill with coal at Hampton Roads and thence proceed to Newport, when they will join the North Atlantic squadron. The fitting out is ordered to be done with dispatch and the department has directed the vessels at Newport by the 13th, if practicable."

Secretary Long sent out the order just in time to catch the officers and clerks at closing up hour of the business of the day. The order went to every department at Washington, to all receiving ships and navy yards of the northern Atlantic coast, and to the marine barracks. Thence it went to the commanding officers of the ships in reserve and to other ships that were to transfer men to them. In a few minutes the entire naval force within the range of the orders was transformed from a body of men just ready to go ashore after a day's work in office and on ship-board to the same number of hustling men, each one bent on making the utmost effort to promptly carry out the emergency instructions from Washington. The wording of the orders could hardly have been more emphatic if an enemy's fleet was off the coast waiting to attack the city and the safety of the country depended upon the haste with which these two fighting ships could get out to sea to head them off. That was part of the scheme. As it happens that this is the first time the quick mobilization idea has been carried out in this country, it is little wonder that folks in and out of the service wondered seriously for a few hours if it really did not have a deeper meaning than a drill on a large scale. And even now there are some who refuse to be convinced that it does not mean something more than the naval officers in high places of responsibility will admit.

The Indiana and Massachusetts had on board when the orders came about 150 enlisted men and a dozen officers each. But each had well-filled bunkers of coal; magazines and shell rooms filled with plenty of ammunition for guns, and stores enough to permit the ships to go to sea the minute the service complements reported on board. The additional officers and men began arriving the following morning. Officers who would have laughed at you the day before if you had suggested to them that they would be going to sea soon, suddenly received telegraphic orders that said: "Go with all the speed of the railway trains." They left their desks in navy yards and Washington bureaus, dumped collars and changes of underclothes into hand bags on top of their uniforms, grasped swords and went, stopping only long enough to say good-by to their families, if they lived near enough. The next morning they were reporting for duty to the commanding officers of the Indiana and Massachusetts and taking up their share of the bustling work they found going on board the ships.

At the same time, on board the receiving ships at the New York and Boston navy yards and in the marine barracks there, on board the receiving ship Richmond and throughout the entire navy yard at League Island, on the receiving ship Franklin at Norfolk, and elsewhere, men and stores were being assembled with a rapidity and certainty that was surprising, except to those who had much confidence in the naval system of doing things quickly and efficiently. On Wednesday morning the men began coming on board the ships, those nearest at hand first, of course. Admiral Sampson's telegram from the Boston navy yard was the first word received from outside the League Island navy yard announcing the departure of men for the ships, and the draft from the Wabash arrived that evening with the draft from the receiving ship Vermont at the New York navy yard, and were put on board the ships immediately. Before breakfast the following morning the old, historic Hartford, just arrived under the same emergency orders from Norfolk, transferred 140 men to each of the ships, these men being westerners with a liking for the navy, which the department has undertaken to satisfy, with good results to the service and the men as well. The first detail of marines came from the Boston barracks, but they were closely followed by forty men from New York, making a picturesque detail in the scene of hasty work with their red-faced capes thrown back over shoulders as they marched on board the tug and a few minutes later went on board the ships, then waiting at anchor in the Delaware River, off the League Island navy yard, for the word that would set them steaming down the 100 miles of fresh water to the ocean.

At 8 o'clock on the morning of Thursday, Capt. Dickins reported the Indiana ready in every way for sea, just forty hours from the time the first order was given. The Massachusetts was reported by Capt. Train as ready about the same time. During the afternoon Capt. Dickins, as senior officer, received his orders from Rear Admiral Casey, commandant of the League Island yard, to proceed to Hampton Roads. At 5:30 o'clock, the tide then serving, the ships got under way and proceeded down the river, the Indiana, with the senior officer's pennant flying, leading, and receiving and answering salutes of whistles and dipping flags along the way. At 8:30 o'clock they anchored at the bar to await the morning tide, getting under way again at 5 o'clock on Friday morning and proceeding down the river, dropping pilots off the capes of Delaware, and then on to Hampton Roads. Meanwhile preparations had been made by Rear Admiral Barker, commandant of the Norfolk navy yard, for the rapid coaling of the ships. Although the ships had well-filled bunkers on leaving League Island, a battleship's furnaces eat up a deal of coal, and for a cruise of any length it is necessary to fill up to the limit, which means about 1,200 tons in the case of these two ships. So on arrival at Hampton Roads everything was found ready for immediate coaling. The colliers Marcellus and Lebanon and coal barges were there and were run alongside the ships by navy yard tugs without delay.

The Indiana and Massachusetts arrived at Hampton Roads at 6:30 o'clock Saturday morning and sailed for Newport at 11:30 o'clock Saturday night. The record of the quick coaling of battleships was broken by the two battleships which took on in about 16 hours probably 1,000 tons of coal and at daybreak were fifty miles up the coast.

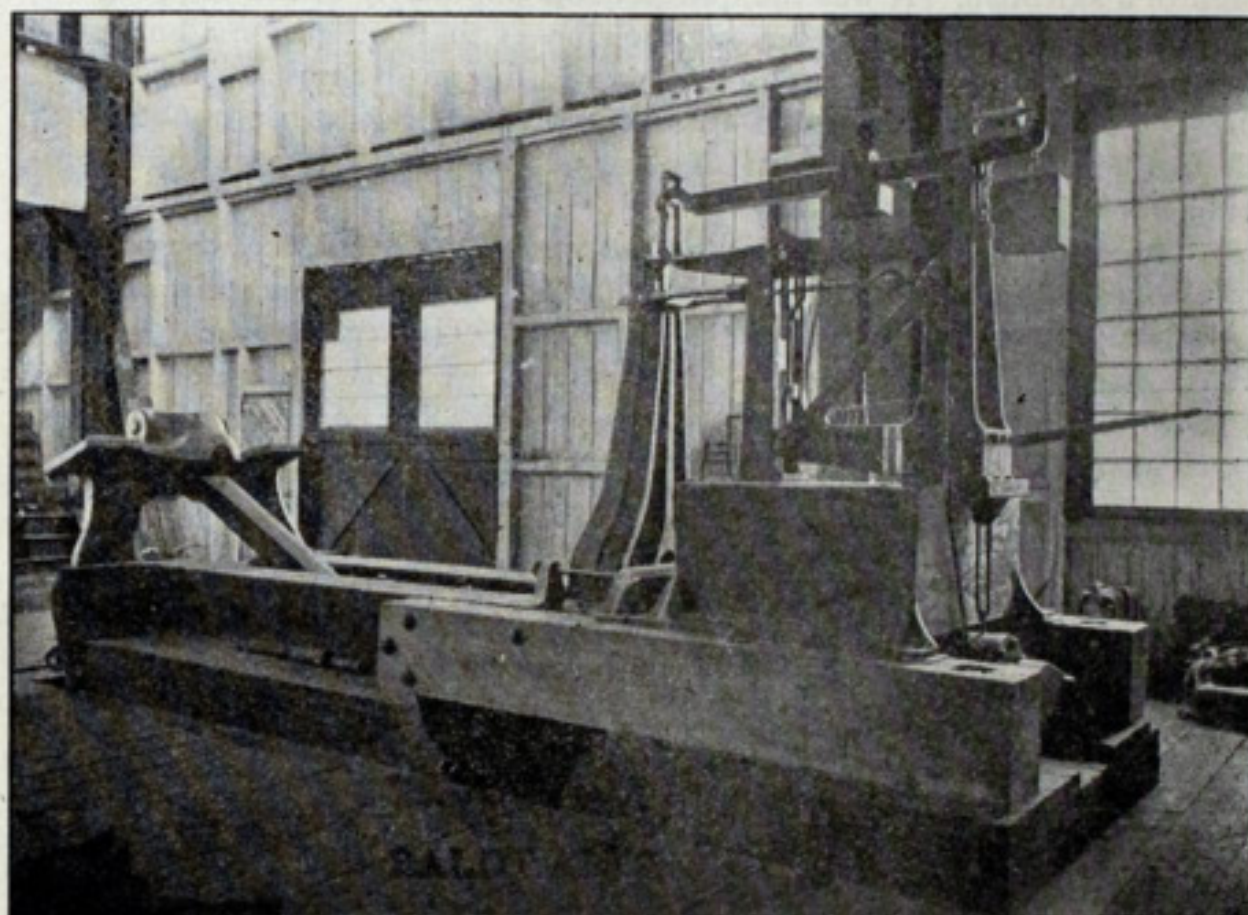
From this hasty review it will be seen that remarkably rapid work has been performed by every department concerned. It was expected that three days would be necessary to get the ships from reserve into active service, but it has been shown that it can be done in two-thirds that time, thanks to the easy working of the naval machinery. Another thing has been demonstrated at the same time, and that is the superiority of the system of laying ships up in reserve instead of putting them in ordinary, or out of commission. People in general scarcely know the difference in the terms in ordinary and in reserve, but there is a great deal of difference. A ship in ordinary is laid up in a navy yard with nobody aboard but one watchman, whose only duty is to look out for fires and trespassers. Navy yard workmen go aboard from time to time and keep guns and machinery and other fittings in as good condition as they can under the circumstances. A ship in reserve, on the other hand, has a small number of officers and a skeleton crew who live on board and keep the ship in thorough condition for service at any time the orders may come. The skeleton crew then expands readily by the addition of new men into a full complement and the ship goes to sea with little delay.

The Indiana and the Massachusetts were the first ships of their class and tonnage to be placed in reserve, and hence this was the first opportunity to try the mobilization idea in haste, as is done by first-class naval powers on occasions to insure the constant readiness so essential for an efficient navy.

## BALDT ANCHOR TESTING MACHINE.

The British admiralty was first to adopt an anchor testing machine, some 100 years ago. It was of crude form and was used for putting a certain amount of strain on a finished anchor, according to its weight, to determine its soundness. Machines have been used ever since for proving anchors and they have had the approval of Lloyds and of foreign shipping authorities.

The Baldt anchor castings are all made of the finest quality of open hearth steel and are first annealed for seventy-two hours; then the coupon or test piece is removed and pulled to determine the strength and ductility of the metal. After this is done the castings are dropped at a distance of 15 to 20 feet, according to their weight and size, on an iron plate, bedded



BALDT ANCHOR TESTING MACHINE.

on a solid concrete foundation, after which they are hammered as a further preventative of any unsoundness. If all these tests are satisfactory to the inspector they are then fitted up complete and pulled in a testing machine as in the accompanying photograph. This machine, built especially for the Baldt anchor, registers 350,000 pounds dead weight and is the only device of its kind in America. Naval requirements and the demands of other users of Baldt anchors, both in England and America, necessitated the construction of a machine of this kind for the works of the Baldt Anchor Co. at Chester, Pa. This company is prepared to furnish anchors of any size and in accordance with any test that may be desired, and on short notice also, as they keep a large stock of anchors on hand for prompt delivery.

## THE GOODWIN CAR.

One of the most important developments in car construction during the past four years is that of the Goodwin car. This car has successfully solved the problem of dumping anything. The cars will discharge tin plate bars, grain in bags, loose grain, broken stone, large rock, steel billets, coal, ore, coke, pig iron, hot cinder, machinery, rail ends, gravel and castings. The car is operated by compressed air or by hand power and the load is discharged by the gravity of the load alone without careening the car or movement of the car body. The Goodwin car is built entirely of plate steel, angles and malleable iron castings. Its weight capacity is 80,000 pounds and its cubic capacity 30 cubic yards. It is in the quality of discharge that the Goodwin car is remarkable. It will discharge on one side, on either side, on both sides at the same time, on one side of the center on both sides of the center at the same time, on the sides and centers at the same time. The angle of discharge is 31 degrees from the horizontal. As the cars can be discharged while running, their utility in ballasting a roadbed can not be overestimated. In ballasting the cars may be operated one after the other by one man, either with or without the use of air. The skill of ordinary laborers is all that is necessary. The amount of material deposited is regulated by the speed of the train or by the size of the opening, and the cars may be discharged standing or while on the run. For the transportation of iron ore and coal the Goodwin car is unrivalled.



# MARINE REVIEW

Devoted to the Merchant Marine, the Navy, Ship Building, and Kindred Interests.

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To epitomize its work in a line 18,191 bills and resolutions were introduced in congress and only 225 of them were sent to the president for his signature; to paraphrase, the mills of congress grind slowly but they grind exceedingly fine—which is well for the country, for of these measures nearly all of them were ill-considered or selfishly promoted. Of the important measures the majority of them are left in a state of gestation. The Pacific cable bill was passed by the senate and reported to the house in an amended form; the Nicaraguan canal bill passed the house and is made special order in the senate for Dec. 10; the bill to promote the efficiency of the revenue cutter service is on the senate calendar ready for action at the next session; the shipping bill has been favorably reported to both houses but is not specially on the calendar of either. This is the most important measure which will come before the short session. Indeed the probability is that it will be passed. The present administration is extraordinary for its timidity. Give it a doubt as to the popularity of a measure and it will become stricken with the palsy. The president is an easily frightened mortal. He will forsake any highway at the least sign of a skirmish. It was the questionable popularity of the shipping bill with those who cannot see beyond their noses that caused the administration to give such listless support to one of the most commendable measures ever offered in congress. Expediency and not merit counts with the present administration. With the elections out of the way the shipping bill will doubtless be in favor.

The distinctive bits of legislation at the late congress were the passage of the gold standard bill which eliminates the money question entirely from the present campaign, the revenue and civil government bill for Porto Rico, the bill to provide a government for the territory of Hawaii, and the naval appropriation bill, which provides for two new battleships, three armored cruisers, three protected cruisers and five submarine boats.

Congress at its last gasp became sensible and authorized the secretary of the navy to purchase armor at his discretion for the Maine, Missouri and Ohio, the Georgia, New Jersey and Pennsylvania, the two battleships yet unnamed, and the armored cruisers West Virginia, Nebraska and California. The secretary, is, however, empowered also to establish an armor plate factory if, in his judgment, the private manufacturers are asking an exorbitant price, and the sum of \$4,000,000 is appropriated for that purpose. This is reposing a vast authority in one man. It is really delegating to the secretary of the navy a power which should remain in congress alone. In a way in making action discretionary with the secretary congress is shirking its responsibility. It wants to meet the popular demand for an increased navy and it does not want the odium of a supposedly excessive price of armor plate upon its head. Secretary Long will doubtless prove equal to the occasion. He need not fear rebuke. The people are willing that he shall pay a fair price for armor plate in order that the completion of the battleships, now under construction, may not be delayed. As far as the establishment of an armor plate factory is concerned Secretary Long is too sensible a business man and too profound an economist ever to undertake it. But what a sop to throw to the unthinking—giving \$4,000,000 to the secretary of the navy for an armor plate factory.

Vessel men in general are bitterly disappointed that the provision of \$6,000 to be expended for the private lights which they have been maintaining was stricken from the sundry civil bill after it had received the approval of the senate; and they cannot help but feel that had one of their members been present to watch it, it would have been protected in conference. It is a matter of vital importance to them as the money is coming directly out of their own pockets. The emergency river and harbor bill retains the Michigan items intact. It gives \$100,000 for the improvement of the Lake George Channel, St. Mary's river, so as to admit of light-draught vessels passing that way and provides for the beginning of work on an additional canal at St. Clair flats. The sundry civil bill, as passed, also contains these items: For continuing the work on the breakwater at Cleveland, \$175,000; for continuing improvements on harbor at Ashtabula, \$110,000; at Lorain, \$125,000; on the Detroit river, \$200,000; Hay Lake channel, St. Mary's river, \$250,000; for constructing a revenue cutter for service on St. Mary's river, \$75,000, one-half of which is made immediately available. The sum of \$50,000 is allowed for ocean surveys.

The Sault power canal bill, upon which so much time was spent, goes over until the next session of congress. The only possibility of bringing

it up in the house was by unanimous consent. Chairman Burton sought to do this, but his ancient enemy, Representative Hepburn, objected. The failure to present the bill, however, will not delay the work of construction. That will progress as usual. If it is true, as has been reported, that the speaker is hostile to the bill there may be some difficulty in getting it considered at the short session. Under the rules of congress the speaker is an autocrat and it is nigh well impossible to get upon the calendar a measure to which he is personally opposed. With a man of pure mind and lofty motive like Reed this works a national benefit; but with a man of contracted vision it may work a considerable mischief.

The relation of the canals to the commercial prosperity of New York was the great subject of discussion at the State Commerce Convention held at Syracuse a few days ago. A number of papers bearing on this subject received the close attention of the convention, which adopted a report setting forth that the future prosperity of the entire state requires the improvement and enlargement of the canals in a manner commensurate with the demands of commerce and to a capacity sufficient to compete with all rival routes. The convention directed the appointment of a committee to present this view of the matter to the state conventions of all the political parties.

It has been rumored of late that Sir William White, director of naval construction for the British admiralty, is about to resign his office. The chief constructor felt keenly the miscalculations which were made in the design of the royal yacht, and while they were made by a subordinate, chose to take upon himself the entire blame for them. Sir William White, however, is one of the most competent men in public service and it is gratifying to know that the rumors are without foundation.

Mr. James Matthews, well known ship owner and head of the firm of James & James T. Matthews, died at his home in Toronto, Ont., last week. He was seventy-six years old and was born at Pickering, Ont. He controlled at one time about twenty vessels.

## AROUND THE GREAT LAKES.

Isaac W. Nicholas, a pioneer ship builder, died at Cleveland on Sunday last, aged eighty-five years. It is recorded of him that he built the first three-masted schooner on the lakes, the Escanaba, which is still in commission. He was interested in the vessels known as the Minch-Nicholas fleet.

From Pittsburg comes announcement of the death of Henry C. Daft, a valued employe of the Carnegie Steel Co., who has of late been acting in the capacity of assistant treasurer and secretary of the Oliver Iron Mining Co. and treasurer of the Pittsburg Steamship Co. Mr. Daft was thirty-one years old.

The Buffalo ore dock, formerly controlled by the Buffalo Dock Co., and which is now managed by Pickands, Mather & Co., of Cleveland; will hereafter be known as the West Shore dock. Mr. C. E. Hebard, who represents Pickands, Mather & Co. on the Minnesota dock at Buffalo, will also have charge of the West Shore dock.

The steamer Unique, which was built for fast service on the Detroit and St. Clair rivers, but which met with accidents to her machinery that gave her a bad name, brought \$11,000 at Sheriff's sale at St. Clair, Mich., Monday. The steamer cost about \$40,000. She was purchased by Mr. Avery of Port Huron and it is said she will be sent down to Ogdensburg, N. Y., for passenger service.

William H. Barnes, Frank J. Firth, S. F. Houston, John P. Green and S. M. Prevost were elected to the directorate of the Erie & Western Transportation Co. at the recent meeting of the stockholders of that line. The Erie & Western, or Anchor line, as it is commonly known on the lakes, is now practically controlled by the Pennsylvania Co. by stock holdings, and the road is represented on the new board by First Vice-President Green and Third Vice-President Prevost.

## SEAMLESS STEEL TUBES CO.

The Seamless Steel Tubes Co. is building a factory at 833 River street, Detroit, Mich. They are now getting machinery into the plant and expect to be in the market with their tubing about Sept. 1. Their specialty will be tubing for steam engineering, namely, boiler tubes for locomotive, merchant marine and other classes of boilers, as well as tubes for high-pressure service, bottles for compressed air and gas, and in fact everything in that particular line manufactured from high grades of steel made especially for the purpose. The president is James McMillan, United States senator from Michigan; Wm. Thornburgh is vice-president and general manager; W. C. McMillan is secretary and treasurer; Geo. M. Black is auditor. Thomas H. Simpson, manager of the Michigan Malleable Iron Co., is also interested in the company. The general office is in the Union Trust building, Detroit.

## PUNCHES, SHEARS, ETC., FOR SHIP YARDS.

The machinists' strike was declared off in the shops of the Cleveland Punch & Shear Works Co. May 28, and most of the old men have been taken back. In the line of ship building tools this company is building a bending and straightening machine, same as illustrated in the Review of April 12, for the Wm. R. Trigg Co., Richmond, Va., and a 24-foot plate planer for the Portland Co., Portland, Me. In their regular line of punches and shears they are completing an order for the Berlin Iron Bridge Co.'s new plant (Pittsburg) consisting of two 48-inch and eight 26-inch punches and one rotary planer with 50 inches cutting head, besides numerous smaller orders for various parties, including two 48-inch double punches for the Eastern Ship Building Co., New London, Conn.



## EXPORTS OF COAL.

HEAVY SHIPMENTS FROM THE UNITED STATES TO FOREIGN INDUSTRIAL COUNTRIES—GOVERNMENT REPORT ON THE SUBJECT—THE UNITED STATES IS NOW THE LARGEST COAL PRODUCING COUNTRY IN THE WORLD.

The remarkable increase in coal exportations from the United States, coupled with the fact that we became in 1899 the world's largest producer of coal, gives special interest to an elaborate discussion of the world's coal product, published by the bureau of statistics of the treasury department in the April number of the monthly summary of commerce and finance. Exportations of coal from the United States in the ten months ending with April, were nearly 50 per cent. larger than those of the same months of the preceding fiscal year and 30 per cent. larger than those of the corresponding months of 1898, while our total production for 1898 was not only the largest in our history, but larger than that of any other country in the world.

For the first time the United States figures show a larger production than the British figures for the same period. The significance of this fact cannot be over-estimated. Coal is now more than ever "the material energy of a country, the universal aid, the factor in everything we do." The relative abundance or scarcity of coal, therefore, is the truest index of a country's position among its industrial rivals.

According to recent information, steamers have been chartered to carry coal from America to St. Petersburg and Stockholm, as well as to Italian, French and German ports. While these exports may be due mainly to the present abnormal conditions of the British coal market, there is no doubt that in time this country will be called upon to supply regularly a large part of the coal needed by foreign industrial countries, which, until recently, have been drawing upon the British output. This is the more probable since cost of production and prices of coal show a falling tendency for this country, whereas the opposite holds true of European coal-producing countries.

The rapidity with which the production of coal has increased may be appreciated when we consider the present volume of that production and reflect in how recent a time the production formed but a very small fraction of that quantity. In 1896 the total coal product of the world was 664,000,000 short tons or 604,000,000 metric tons. Until as late a period as 1878 the world's product had never been half so great, being then only 202 million metric tons, and not until 1868 had the world's production been as much as a third as large as it is at present. In 1864 the world's product was only 174,000,000 metric tons, or less than 29 per cent. of that of 1896. The statistics of the world's production for still earlier periods can not be determined with any pretense of accuracy; but on the basis of the British statistics from 1854, and of estimates for earlier periods and from such statistics as are obtainable from France, Germany, Belgium and Austria-Hungary, an approximation may be made to the actual production. In 1860 the world's production of coal was about 144,000,000 metric tons, or less than one-fourth that of 1896 and much less than that of either the United States or the United Kingdom at present. Ten years earlier the world's production amounted to only about 83,000,000 metric tons, or about two-fifteenths of the present world's production, and considerably less than the present output of Pennsylvania alone. In 1840 the production was much smaller still, but about 45,000,000 metric tons, or about one-thirteenth of the present output, while during the three-quarters of a century since 1820, when the output was about 17,000,000 metric tons, the production has increased 3,500 per cent.

The production is chiefly in the hands of three nations, the Americans, the British and the Germans. During the last thirty years, and even earlier, the combined output of these three countries has averaged year for year about five-sixths of the world's total output. Possessing but about 10 per cent. of the world's population, they have produced about 33 per cent. of the mineral fuel, while the remaining 90 per cent. of the world's inhabitants have produced only about 17 per cent. of the coal, and even if the savage and semi-barbarous nations be disregarded, the immense preponderance of coal production in these countries must be conceded. To this group might be added Belgium, which produces and consumes more coal per capita than any other country except the United Kingdom, but for the fact of its small population, placing it in the second rank of coal-producing countries.

While the continued output of these three countries has kept pace with the production of the rest of the world, their relative position has been materially altered. In 1863 the United Kingdom produced over three times as much as either the United States or Germany, the output of these countries being approximately 12, 14½ and 16½ per cent. of the world's production, respectively. By 1875 the output of the United Kingdom was still considerably greater than the combined output of the United States and Germany, their proportion of the total being 45, 20 and 18 per cent., respectively. The next half-decennial period witnessed a remarkable increase in the American product and a corresponding relative decrease in that of Great Britain, the respective proportions being 36, 28 and 17 per cent. This increase was maintained in the present decade and in 1896 the output of the United Kingdom was only 34 per cent., that of the United States 30 per cent., and that of Germany 19.2 per cent. of the world's total output. These statistics clearly show that the United Kingdom is rapidly losing its former pre-eminence as a coal-producing power, and that while its production is increasing rapidly, its absolute increase is less than that of the United States, and its relative increase considerably less than that of either the United States or Germany. In 1868 the production of these three countries, the United Kingdom, the United States and Germany, in the order named, was 115,500,000, 31,600,000, and 36,200,000 net tons; in 1897 their output was 226,000,000, 200,200,000, and 132,700,000 net tons respectively. The absolute increase in the British production was 110,900,000, as compared with 96,500,000 for Germany and 168,600,000 net tons for the United States. The proportional increase during these three decades (1868-1897) was 96.4 per cent. for the United Kingdom, as compared with 266.1 per cent. for Germany and 532.3 per cent. for the United States.

**CHARTS OF THE ST. LAWRENCE.**—It frequently happens that owners of steam yachts passing between the lakes and the Atlantic want charts of the St. Lawrence river, and want them in a hurry. The Marine Review has them on hand all the time—complete from Lake Ontario to the Gulf of St. Lawrence.

## REPORT OF THE CANAL COMMISSION.

The senate showed a proper appreciation of the gravity of the Isthmian canal question by refusing to take up the bill for the immediate construction of the Nicaragua, which was passed in such unseemly haste by the house. Its refusal to enter upon a premature debate was no doubt largely due to facts brought out at a preliminary hearing of the engineers of the canal commission by the senate committee on interoceanic canals, of which Mr. Morgan is chairman. Although the members of the commission very properly refused to commit themselves, at the present stage of their incomplete investigations, to any exact statement of the relative cost or feasibility of the Nicaragua and Panama routes, enough information of a general nature was presented to prove that the question of the best route is yet an open one, and that the passage of the Hepburn bill by the house was precipitate, and contrary to the dictates of prudence and forethought, by which the discussion of this great national project should be governed.

It is impossible to review the interesting report of this hearing at any length, and it must suffice to quote a few of the salient features of the testimony. In the first place, then, it is the opinion of every member of the commission that both canals are feasible; and while no exact estimate of cost was given, Col. Ernest stated that in his opinion "it would cost less money to finish the Panama canal than to build the Nicaragua canal." There was a consensus of opinion that the present plans of the French engineers had solved the three great problems of the Culebra cut, the summit water supply, and the control of the Chagres river, and the impression produced upon the committee was voiced by Senator Sewell (of the committee), who said: "We have been educated for the last ten years with the idea that the Panama canal was an impracticable thing, and it has only been within the last month or two that we have heard from your commission, not officially, but from individual members, that it is an open question whether the Panama canal could not be finished just as cheaply as the Nicaragua canal could be built."

On the question of harbors, Admiral Walker stated that it would be easier to make a harbor at Colon (Panama) than at Greytown (Nicaragua), while at the Bay of Panama, on the Pacific, there would be "really no necessity for a harbor." Speaking on the same subject, Mr. Morison testified that the construction of Greytown harbor (Nicaragua) would be a "work of unusual difficulty and magnitude," and in common with the great dam across the San Juan, "must be considered a very great obstruction in an engineering sense." At the same time he considers that these engineering difficulties can be surmounted, since "everything is feasible in construction to an engineer, provided he has sufficient time and money."

The imperative necessity of waiting for the report of the commission is shown by the fact that, as regards Nicaragua, the Walker survey, according to Colonel Hains (a member of the Walker commission), was a "paper location," whereas the present commission are "locating the canal on the ground itself." Hence it is not surprising that the new estimate of cost will be greater than that of the Walker commission. The more rigid examination has revealed among other things the fact that the dam on the San Juan will be a far more costly affair than was supposed. According to Mr. Morison, it will be necessary to go down 100 feet below the low water level of the river to secure rock foundation, and work at this depth will involve the use of the pneumatic process. This is deeper than the foundations of the Mississippi bridge at Memphis, which measured 60 by 100 feet. As the foundation of the dam will be 120 feet wide by 1,500 feet long, we can appreciate Mr. Morison's statement that "it is going to cost an enormous amount of money."

We could quote at further length from this report, but we think enough has been said to show that the question as to which is the best canal for the United States government to construct and own is still very much "in the air," especially when we bear in mind that other possible routes, such as that at Atrato, are also under consideration and may yet prove to have superior advantages over the two great rival routes above considered.—Scientific American.

## NEW LINE TO TAHITI.

J. Lamb Doty, consul to Tahiti, writes to the state department that a contract has been awarded to the Oceanic Steamship Co. of San Francisco for the establishment of a steamship line between Tahiti and San Francisco for the transportation of mails, passengers and freight. The essential features of the contract are as follows: For the annual sum of 156,000 francs (\$30,000 in United States gold) to be paid by the Tahiti government, and exemption from port charges, the Oceanic Steamship Co. is to operate an American steamship of about 3,000 tons gross register, performing eleven round trips per annum at an average speed of not less than 13½ knots. The contract is awarded for a period of five years from the first voyage, which is to be made not later than Nov. 1, 1900, and earlier if possible. It is the purpose of this company to use a first-class passenger steamship and to make the service attractive in all particulars; and it is anticipated that this will become a favorite route of travel, when the charm of the climate and scenery of Tahiti become known. The inauguration of this line will give great impetus to United States trade with Tahiti and, in general, with other islands of eastern Polynesia. The Pacific coast of the United States will be particularly benefited, as perishable goods—such as fruits, vegetables, and meats—which now are received exclusively from New Zealand, will then come from San Francisco.

## MARQUETTE, ON LAKE SUPERIOR.

is one of the most charming summer resorts reached via the Chicago, Milwaukee & St. Paul Railway. Its healthful location, beautiful scenery, good hotels and complete immunity from hay fever, make a summer outing at Marquette, Mich., very attractive from the standpoint of health, rest and comfort.

For a copy of "The Lake Superior Country," containing a description of Marquette and the copper country, address, with four (4) cents in stamps to pay postage, Geo. H. Heafford, General Passenger Agent, Chicago, Ill.

July 26

One fare for the round trip within a radius of 200 miles on the Nickel Plate road on July 3 and 4. Tickets good returning until the 5th, inclusive. Write, wire, phone or call on nearest agent, C. A. Asterlin, T. P. A., Ft. Wayne, Ind., or E. A. Akers, C. P. & T. A., Cleveland, O.



## MR. HANNA ON ARMOR PLATE.

HE DISCUSSES THE SUBJECT CLEARLY AND LOGICALLY IN THE UNITED STATES SENATE—A COMMON-SENSE BUSINESS ARGUMENT.

Senator M. A. Hanna took the floor in the senate during one of the closing days and held it for an hour. He participated in discussion on the armor plate controversy. There was nothing oratorical about him. But the common sense of a business brain was in evidence. He discussed the question simply and clearly. His statements were in striking contrast to the unjust and unworthy exaggerations of Tillman. For the merit that is in it, the Review reproduces that portion of the congressional record which contains Mr. Hanna's remarks in full:

"Mr. President, I have had the honor to be a member of the naval affairs committee since I have been in this body, besides having had some little experience with manufacturing industries before I came here; and although I have not had the five years of investigation and experience that some of my colleagues have, I pretend to know something about the manufacturing business and something about the manufacture of armor plate, from investigation and absolute personal knowledge. I have refrained from taking any part in this discussion, because I believed it to be the prerogative of a senator to hear the arguments frankly expressed and then to judge for himself upon the merits of the proposition. This contest on armor plate began several years ago, and, as has been stated by the senator from South Carolina and the senator from New Hampshire, the construction of ships provided by congress has been delayed, owing to the failure on the part of the house or the senate, or both, to reach an agreement on the price of armor plate. I say, as a result of my observation, that the responsibility for the failure of the construction of those ships rests upon the individual efforts of those two senators in placing the price of armor plate below what any concern in the United States or Europe, or the United States government itself, could manufacture it for. That is the whole trouble with this matter, and the senator from South Carolina has given to you the animus of the whole situation when he says that he would rather see the bill fail—and consequently a failure of the progress of our navy and the development of our marine power—than to be defeated upon a proposition which is untenable from a manufacturing standpoint. I am not here to defend or uphold any manufacturer or any corporation but I say upon my own responsibility that \$445 a ton is a reasonable price, yea a low price, for this material under present conditions. It is a price below what any nation on earth is paying to-day, a price which nobody here yet has stated upon knowledge of facts and figures is a high price.

Mr. Wellington: Will the senator from Ohio permit me? I have a very distinct recollection that in the house of representatives not only was it proved by investigation that armor plate could be made for \$240 a ton, but the Illinois Steel Co. offered to make it for \$260 a ton.

Mr. Hanna: I believe that testimony was produced in some investigation. I happened to know something about that investigation, and I know that that proposition was a pure bluff. The then president of the Illinois Steel Co. made the offer in personal pique against other manufacturers of armor plate, just as he has since been guilty of other transactions of the same nature. It was a pure bluff.

Mr. Penrose. I should like to interrogate the senator from Ohio. I should like to ask him whether that bid was not based upon the guaranty on the part of the government that orders for some 6,000 tons annually should be furnished to the establishment?

Mr. Hanna. Yes; but he had no idea of getting the contract, and did not want it. I do not want to take up any time in a dialogue on this matter. I simply desire to state the facts as I know them, and I propose to present them fairly. The cost of making armor, of course, depends largely upon the cost of the raw material and labor. There has been an advance of fully 25 per cent in both since the question was under discussion before, and particularly in labor, which amounts in these works, I am told, to over 30 per cent. Therefore the conditions are not quite so favorable now for regulating the prices as they have been. While I have not fully considered and do not know what is the best basis upon which to compromise this, I do know and I do feel that under those conditions some discretion given to a man of the ability and integrity of our secretary of the navy would be greatly to the advantage of the United States in watching his opportunity as he makes contracts, not perhaps in gross tonnage, but from time to time as he sees that it is for the best advantage of the government to do so. I want to know whether the character and integrity of that officer are any less to-day than they were when the United States placed at his disposal \$22,000,000 for expenditure during the war. I want to know whether the political ambition of a man of his character can interfere with his judgment and his integrity in the discharge of his public duty. I resent any such imputation upon any member of this government. Mr. President, it has been stated here by several senators, with respect to the ability of the government to build an armor plant, that it can be done in a year and a half or two years. It can not be built and completed and prepared to furnish armor to the government in five years. These immense compressors or presses are only made in two places in the whole world. It would take three years before one of them could be built.

Mr. Tillman. Has the senator read the testimony of Mr. Carnegie before the committee, in which he stated that after having built his addition to his steel works he was able to make armor and deliver it within nine months from the date when he received the contract? When the senator is so reckless in his personal opinions I must call his attention to the facts.

Mr. Hanna. If I ever grow to be as reckless in my assertions as is the senator from South Carolina, I shall feel very bad about it. Of course, if Mr. Carnegie had his works complete and his machinery prepared and ready for production, he could make armor plate or any other material inside of nine months; but I say, and I repeat it, that no man and no corporation and no amount of money can produce one of these compressors inside of three years, because it cannot be made in a shorter time. The immense machinery connected with the whole outfit of armor-plate manufacture is of the same nature. It so happens that at this time the whole world is busy. The manufacturing industries in this country are driven to their utmost. You can hardly buy an engine of a thousand

horsepower short of a year to a year and a half delivery. When you state that this government can build an armor plant in a year and a half or two years, you are stating what is not true. It is not so.

Mr. Tillman. In view of his statement a moment ago, the senator will recall the fact that several steel mills have been shut down because of want of work.

Mr. Hanna. That is the same man who made the offer of \$245 a ton, who is said to have shut down the mills to influence the stock market.

Mr. Tillman. It shows how unscrupulous men get to be when they get to be millionaires through trusts. They not only get to be liars, but thieves, also.

Mr. Hanna. The senator does not mean to call anybody a liar?

Mr. Tillman. I am not calling any individual a liar. I am only speaking in general language.

Mr. Hanna. I do not propose to go into that branch of the subject, either. I have no hesitancy in saying, and I repeat what I said, that an armor plant can not be built and completed in five years; and I have no hesitancy in making a further prophecy, that no matter when it is built or completed, the government of the United States can not manufacture armor plate within 50 per cent of what it can buy it for. I know how these things are conducted. I know what it means. The bare, naked armor plant is nothing compared with the entirety of such an organization. If you are going into anything economically, you have to commence at the base—the raw material; you have to make your pig iron and your steel, and through all the ramifications of manufacture you have to absorb every profit to the government in order to economize. You must have your experts; and then I want to know where you are going to get your knowledge by which you can manufacture the Krupp patent armor. I have heard it stated several times during this discussion that the United States government could secure that.

Mr. Tillman. We only have the testimony of Admiral O'Neil.

Mr. Hanna. I do not care whose testimony the senator has. I am stating my proposition. I am stating my own proposition upon my responsibility.

Mr. Tillman. The senator first appealed to us not to impeach the honor and integrity of John D. Long, in which I agree with him, and then he turns around and repudiates the admiral in charge of the ordnance bureau as unworthy of belief.

Mr. Hanna. I appeal to the senator as I am a tyro here to give me half a chance.

Mr. Tillman. I will not interrupt the senator from Ohio any more.

Mr. Hanna. I thank you. The cost of armor plate depends on the iron ore and so through all the ramifications of its manufacture, in every step and process of which labor is involved to the extent of 90 per cent of it. That is the proposition you are obliged to confront to-day. Then there is the advanced price of skilled labor in this country. When you talk about taking anybody and everybody into such a manufacturing establishment, men who know nothing about the processes, you would be running a risk that the United States government could not afford and would not take. You have got to have skilled mechanics, and you have got to have men who have been trained from the beginning of this operation, or else every plate you manufacture will be a failure.

Mr. Allen. I should like to ask the senator from Ohio if the government can not get that skilled labor?

Mr. Hanna. They can get it if they hire it from other people who have it.

Mr. Allen. Very well. Why not do that?

Mr. Hanna. If you would pay higher, you could get it in that way, probably.

Mr. Allen. Why not do that?

Mr. Hanna. I thought you were studying economics.

Mr. Allen. I am studying economics. I assume that when the recent secretary of the navy, Mr. Herbert, reported that this plate could be made for \$192 a ton, and a great profit made on it, he was sufficiently near the truth, and that between that margin and \$445 a ton the government might be able to make some money.

Mr. Hanna. I do not believe that plate could ever be made for \$192 a ton.

Mr. Allen. Mr. Herbert made the statement, and it is on file here.

Mr. Hanna. I am not disputing Mr. Herbert; I am stating my opinion; and I think I know as much about the subject as ex-Secretary Herbert.

Mr. Allen. Does the senator own armor plate?

Mr. Hanna. No; but I have been in the manufacturing business, and I have been connected with a steel plant for a great many years.

Mr. Allen. Has the senator ever manufactured armor plate?

Mr. Hanna. No; I have not.

Mr. Allen. I mean outside of political armor plate.

Mr. Hanna. No, sir; but I have found it pretty invulnerable. (Laughter.)

Mr. Allen. With the means employed by the senator from Ohio in producing invulnerability, I have no doubt he has found it so.

Mr. Hanna. Thank you. Now, Mr. President, I made the statement at the beginning of my remarks that I did not think \$445 a ton was an excessive price, and I think I know what I am talking about. If either of these concerns that have been manufacturing armor plate in this country had devoted the same amount of capital and attention to any other branch of their manufacturing business, they would have made two dollars where they have made one in the government work they have done. There is not any branch of the steel industry but what, if they had devoted the same amount of capital and labor in its construction, would have brought a better remuneration. The amount manufactured up to this time has averaged less than 2,000 tons to a plant, and on the cost of that manufacture, with the returns that they have received, they have not made much more than 6 and 10 per cent on their investment; and that is not a manufacturer's profit; it should not be. Now, with reference to the situation of this bill, I have trusted to abler hands and more experienced ones the management of the affairs of the naval committee. I have been willing to support the majority of the senate and leave it for our conferees to attempt at least a settlement of this important question without any personal feeling or prejudice in this matter. But I protest that when it descends to a personal matter and when



the senate has settled this question by an unanimous vote, that question should rest there and go where it belongs for a final settlement, to the conferees. I do protest further that the individual effort by parties who would rather see this bill fail than that they should yield should not be the governing influence in the decision of this important question.

Mr. Tillman. Mr. President, the senator asks me not to interfere with a tyro, and I would not do it if his remarks were not now in the direction of personal remarks.

Mr. Hanna. I will waive it.

Mr. Tillman. The senator a few moments ago took occasion to say that it was owing to the efforts or to the work of the senator from New Hampshire and myself that we were in this condition. While that is one of the highest compliments I have ever had paid me, I leave it to senators here, who have been convinced by arguments and facts presented in this discussion before the senator came into this body and since he has been here by which the senate has voted once, the first time, by a vote of three to one and every time since by a vote of two to one that we were right, to decide as between his assertion that it is a personal matter, a personal triumph, or whether senators here are independent and act upon their responsibility after they have received proper information.

Mr. Hanna. I have nothing to take back, nor do I intend to drift into any personalities in this discussion. I have not been here as long as either of the other senators, but during the time I have been in the senate I have been on the naval committee, and as far as my intelligence and perception would carry me I have studied this question, and I think I understand it. I have risen to say what I have said only because I saw the drift of things and what the intention was, to try to get the bill back from the control of the majority who have decided this question. I stand with the chairman of my committee. I am willing to trust to him and his colleagues on the conference to bring about a fair settlement of this question, a settlement with which the government ought well to be satisfied. I am in favor of the growth and development of our navy and of our maritime power in every direction, and therefore I do not want to see any misstatements or misleading facts, ignorantly perhaps, brought to bear upon members in this chamber to influence them to change their votes if they have voted as their conscience and their judgment dictated in the first instance.

Mr. Allen. Mr. President, it is idle to say, it would be a foolish thing to say before children ten years of age, not to mention men of large experience in the world, that this government, with all its resources, can not build and operate an armor plant and build armor plate more cheaply than any private institution. I ask the senator from Ohio if we do not to-day manufacture the best parts of our cannon, whether for use on land or on sea, at our navy yards?

Mr. Hanna. I will answer that question if the senator will allow me.

Mr. Allen. Certainly.

Mr. Hanna. All the United States government does in the manufacture of cannon is to put the steel together, which is manufactured at Bethlehem for them at an expense of about \$700 a ton.

Mr. Allen. We manufacture at government expense and under government direction the very best armament for naval or land defenses that is manufactured upon the face of the earth.

Mr. Hanna. No; we only finish it.

#### WHY THE CHESTER W. CHAPIN WAS BUILT.

Few people know why the Sound steamboat Chester W. Chapin, now owned by the New York, New Haven & Hartford consolidated road, was built. Upon the best of authority we can say that the building of this boat was a shrewd business move of her namesake, Chester W. Chapin, the president of the New Haven Steamboat Co. The object of building was to obtain two splendid modern twin-screw passenger steamboats—the Richard Peck having already proved all that was desired in actual service—and with such a service to worry the railroad company into purchasing the steamboat company. The consolidated road started two years ago to "tie up" the New Haven line. Then Mr. Chapin put the Peck and the Northern on a line between New York and Providence in direct opposition to the railroad. The latter could not keep the New Haven steamboat passengers and freight out of Boston over one of the leased lines of the railroad, as the interstate commerce law makes discrimination impossible. No one supposed that the New Haven boats could make much money in opposition to this powerful railroad, but they bravely kept it up until the Chapin was built, after which she with the Peck brought the railroad to terms. Thus was carried out the object for which the Chapin was built, and it enabled Mr. Chapin, the man who devised the scheme, to dispose of the line in which he was the largest owner and to spend the summer in Europe untrammelled by cares, while the N. Y., N. H. & H. R. R. Co. has more steamboats than they know what to do with. The Chapin was designed by A. Cary Smith and built by the Maryland Steel Co. She is smaller than the City of Lowell but about the same size and speed as the Richard Peck.

#### MECHANICAL DRAFT.

The rapid strides which mechanical draft is making as a substitute for chimney draft are well exemplified by a statement recently made by the B. F. Sturtevant Co. of Boston—pioneers in the introduction of the fan in the place of a chimney—which is to the effect that their sales of apparatus for stationary boiler plants were last year over three times those for the year before and that they now amount to nearly 1,000 h. p. per day, about equally divided upon stationary and marine plants. It is also interesting to note that in a number of the technical schools of the country experimental mechanical draft apparatus has been installed, principally for the purpose of instruction, and that numerous graduating theses are concerned with the investigation of this subject.

The White Star liner Oceanic, biggest of ocean crossers, has put herself in the 21 knot class of twin screws. She completed off Sandy Hook lightship a run of 5 days, 21 hours and 47 minutes from Queenstown, averaging 20.37 knots per hour. On the second day she logged 524 knots, the weather being fine and the sea smooth. Her hourly average on this, her best day, was a fraction more than 21 knots.

#### TRIAL TRIP OF THE MANNA-HATA.

The Manna-Hata, new steamer for the New York-Baltimore service of the Ericsson line, built by the Harlan & Hollingsworth Co., Wilmington, Del., made her trial trip down the Delaware river recently. The performance of the steamer was satisfactory in every way. The Manna-Hata is 205 feet long between perpendiculars, 219 feet long over all, 32 feet molded beam, 23 feet 3 inches depth of hold at center from upper deck, 14 feet 6 inches depth from main deck, lower hold. The hull is constructed of the best mild steel. The frames are 4 by 3 inches, 7 pounds weight, spaced 24 inches centers, each being in one piece from center of keelson to upper deck stringer. There are four water-tight compartments, the bulkheads extending to lower deck.

At the bow, below water line, all plates, as far as the side ports, are of 16 pounds for ice service. The bottom and sides are 18 pounds for one-half length, and 12 pounds at ends. The rudder is of cast steel, the diameter of stock being 4½ inches. All frames at bulkheads are doubled, and the frames under the boiler and engine are doubled to the turn of the bilge. The tanks have a capacity of 9,000 gallons of water. The boiler and engine space is all inclosed in a steel well, thus minimizing the danger from fire. The vessel is equipped with a Hyde windlass. All modern improvements for the rapid handling of cargo are included in the vessel's outfit. There are three Williamson steam hoisters on the main deck, with steel cargo cranes and booms situated directly over the lower hold hatches. A complete electric light equipment, supplying 86 lights, is included.

The engine is of the triple expansion, three crank, surface condensing type of the open-front style of build. It has cylinders 18, 28 and 45 inches diameter by 30-inch stroke. Steam is supplied by two Scotch boilers, each 11 feet in diameter by 10 feet long. The propeller wheel is four-bladed, 10 feet in diameter and 14 feet pitch. The tonnage of the Manna-Hata is 1,103 gross and 735 net tons.

The deckhouse is of steel, and in it are located the quarters of all of the officers and crew. The captain's room is commodious and finely furnished. It is directly aft of the pilot-house. The pilot-house also is roomy and well fitted. The quarters for the crew are on the starboard side of the ship, while those of the engine department are placed on the port side.

#### MESABI OPEN-PIT IRON MINES.

Engineering of London has contained of late several articles dealing with conditions that have led up to prosperity in the iron and steel industry of the United States. Following is an extract from one of these articles relating to open-pit mining on the Mesabi range of Minnesota:

"The present prosperity of the iron trade in the United States is attributable in quite an appreciable degree to the discovery of certain mines in the Mesabi range in which the ore can actually be dug by a steam shovel. But little blasting is needed in these mines, and that only to loosen the material ready for the shovel. The mines are open cuttings, and rails of standard gauge are laid right into the workings. The character of the ore is well illustrated by the fact that as many as 230 cars, each holding about 25 tons of ore, have been loaded in 9 hours, and on occasion six such cars have been filled in 12½ minutes. The shovels lift from 3 to 7 tons at a time, a usual capacity for the bucket being 3½ cubic yards. Considerable power is needed for working the shovel; a locomotive boiler having a shell 56 inches in diameter being commonly used to supply the steam needed. There are generally three independent sets of engines, one of which does the lifting, another the slewing, whilst a third is used for forcing the shovel into the mass of ore. Such a shovel, fitted complete, weighs nearly 100 tons, and requires a crew of eight or ten men to work it. They are built almost entirely of steel or wrought iron; cast iron being little used, even the castings being of steel. It is common to flitch the steel framing with wood, which renders the structure much less readily deformed by accidental blows, though aiding little to its statical strength. The whole is mounted on trucks fitted with wheels set to run on standard-gauge lines, and is self-propelling, generally by means of chain gearing. This can be disconnected at will and the shovel made up as part of a freight train. The shovel can be 'dumped' at a height of 17 feet above rail level; but when the jib is lowered, the height for travelling can be reduced to 14 feet. At the mines the wagons are handled and brought up to the shovel by a separate locomotive. The shovels have proved so satisfactory in working that they have also been largely used at mines yielding harder ores, but in these they are not used in actual mining, but merely to load wagons from the stock piles. They are similarly being now applied at the receiving ports on Lake Erie, for loading the ore into the railway wagons for transmission to Pittsburg and other smelting centres."

#### POWHATTAN A QUARANTINE STEAMER.

The Powhattan, formerly an auxiliary gunboat of the navy, has been transferred to the United States marine-hospital service and is to be stationed at the national quarantine station at Reedy island, where she will be assigned to duty as a boarding vessel. The Powhattan is a large sea-going tug boat of 108 feet length, her beam being 21 feet, and extreme draught 11 feet. The hull and deck house are of steel. Her motive power consists of a triple expansion engine of 400 indicated horse power and a two-furnace Scotch boiler carrying a steam pressure of 160 pounds per square inch. The maximum speed of the vessel is about 12 knots, or 13.8 statute miles per hour. She is provided with large wrecking and fire pumps, steam deck capstan, a complete electric plant and search light.

The Powhattan is a modern vessel of first-class construction and is extremely well suited for the boarding duty at Reedy island. During the war she mounted several rapid fire guns and was used by the navy as a blockading and patrol gunboat off the coast of Cuba. She was built at Sparrow's Point, Maryland, in 1892, and was originally named the Penwood, the navy department having purchased her from a southern construction company at Mobile. The Powhattan was transferred to the marine-hospital service in 1899 and was at first stationed at the national quarantine at Dry Tortugas and Key West. For several months she has been at the Neafie & Levy ship yard, Philadelphia, where she has received a thorough overhauling under the supervision of the Superintendent of Construction, C. M. Green of the revenue cutter service. This work is now completed and the Powhattan will leave at once for Reedy island.



## FIRED AT A REAL SHIP.

COMMENT ON THE LATEST EXPERIMENT OF THE BRITISH ADMIRALTY—LES-ON SEEMS TO BE THAT THE BATTLE BELONGS TO THE VESSEL WHICH GETS IN THE FIRST BLOW AND THAT THE 12-INCH IS THE GUN OF THE FUTURE.

(By a Correspondent of the Engineer of London.)

Beyond being able to assure your readers that the average account of the Belleisle experiments is pure invention, it is impossible at present to say much. But a few notes on such observations as it was possible to make may at any rate be of interest. Fire was opened at 1700 yards, the Belleisle being then end-on. Those 6-inch guns which fired common shell charged with lyddite were concentrated forward, those firing common shell with powder, aft. The big guns were ordered to aim amidships, and the second 12-inch A. P. did for the ship. The rest was mere banging.

Almost immediately after opening fire the Belleisle was invisible in the clouds of steam, coal dust, and smoke from bursting shell. For the most of the seven and a half minutes the gunners upon the Majestic's main deck never saw the target, while, in addition, they were greatly incommoded by the smoke from the big guns. These, and the upper-deck 6-inch guns did most of the hitting. No single shot went wide, but many went just over or under. About 30 per cent. hit, and of these many passed through without bursting; the number that did harm was, therefore, comparatively small. That harm, however, was enough to put the ship out of action at once, and only one of the dummy crew "survived." Towards the end the funnel was knocked clean out of the ship by a 6-inch lyddite shell, but both the masts stood after the action, as also did most of the guns, despite stories to the contrary. The engines and everything else below the water line were absolutely untouched; and altogether, severely as she was punished, the old Belleisle stood the ordeal infinitely better than any of the Admiral class—"first-class battleships"—could have done. The first conclusions arrived at by the officers of the channel fleet were as follows:

1. Save in absolutely still water, a complete water line belt has no value whatever.
2. It is easier to hit a ship end-on than when she presents her broad-side.
3. The battle of the future will be won by whoever gets in the first hit or first one minute's hitting.
4. The theorists have been shown to be correct in nearly all their theories.
5. Danger of fire from woodwork is quite a minor affair, and if the main hoses are protected, and the ship well doused beforehand, no serious danger is to be apprehended from fire.
6. The 12-inch is the gun of the future.

I may add that while the newspaper accounts of the ship blazing like a tar-barrel are pure fiction, Mr. Goschen's statement in the house of commons that the ship was not fired is nearly as fictitious. Those who went on board immediately after the firing saw very little, owing to the smoke still hanging about her.

(FROM THE ENGINEER OF LONDON.)

It is very rash to attempt to review an experiment of which the circumstances are kept secret, more especially when it is conducted by authorities as capable as those at the admiralty. We do not, therefore, now attempt to review the trial in the usual way, but only to notice the results that were necessarily known, and to consider how the matter must present itself to those outside the very limited number of persons who had access to the exact objects in view, and the precise results produced. Limiting ourselves in this way, we shall be justified in expressing our opinion freely.

The actual operation was the destruction of the Belleisle in five, or we may say, in three minutes, by the Majestic, though the firing continued for 9¼ minutes in all. The Belleisle is a cross between a central battery ship and a coast defender. She was built for Turkey, and purchased by us in 1878. She has a belt and central battery, with wrought iron armor from 12 inches to 6 inches thick, but nearly three-quarters of her hull above the belt is unprotected. This structure the Majestic attacked with her four 12-inch guns and her broadside batteries of 6-inch quick-firing guns—six on each side—and her lighter guns. Speaking generally, no one could doubt as to the result. The Belleisle could not fail to be "riddled and gutted" in a few minutes. To the uninitiated a most costly and invaluable target was apparently destroyed, and the goose that might have laid the golden eggs killed with a vengeance. We refuse to believe that there was not something more than this behind, but we think it a pity if some statement to this effect is not made by the first lord, for this is how the matter must present itself to the public.

Even as the trial is reported, however, there is something to note. First as to accuracy of fire. The Majestic opened fire at 1,700 yards range while steaming at 6 knots an hour, with a 12-inch gun, which entered the stern of the Belleisle, raking her, if we are to believe the reports, and emerging at her bows. This we regard as admirable, for it was necessary for the Majestic gun to be laid correctly and got off almost exactly when the line of the Belleisle keel coincided with the line of sight. The projectile must have traversed the length of the ship, passing through the armored bulkheads or walls without serious deflection. We hail so good a shot, specially at the present time. Very able criticism of the American firing at Santiago has resulted in one case in the conclusion being arrived at that the disturbing causes in that action were so great, and the resulting probable error found by working backwards so erroneous, that it was quite a matter of indifference what the shooting of the guns was, and that the difference between the most hopeless old smooth bore and the best rifled gun would have been nothing to signify. We have always held that at Santiago the circumstances were just those which must cause, and indeed justify, wild shooting. A group of ships after the monotony of weeks of watching, suddenly see an enemy moving out and making away at four miles range from most of them, an enemy who ought to have the heels of them. It was a case when the only apparent chance was to fire at once and chance a hit at the cost of great waste of ammunition. Subsequently, when the Spanish speed proved deficient, and when the Amer-

ican ships were gaining on them, the chances greatly improved. Had they attained to racing abreast of them, which hardly happened before the Spanish cruisers were destroyed, it would have been easy to direct a discriminate fire attack; but as it was, the whole engagement was a wild, unexpected race. The Majestic's first round shows what can be done by the heavy gun of a vessel steaming at 6 knots, and availing herself of a chance which could only present itself for a moment. The shell attack which followed was apparently well directed, but in present circumstances we learn little from it. The destruction at Santiago, however, emphasizes the fact mentioned by the first lord apparently as the leading one in the Portsmouth trial, namely, the circumstance that the Belleisle did not actually take fire. This, if wholly instead of partially true, is very important. In the German warships all wood has been condemned and dispensed with for some time past; the experience at Santiago seemed to show that we had lost much by not doing the same. If, however, wood can be protected by any means, things are not quite as was supposed. Apparently, water was very freely used in the Belleisle. However, on this we may hope to hear more shortly.

Nevertheless, we think the program was disappointing, although the results were as good as such a program might offer. We should have liked to have learned the effect of individual rounds of various kinds, even if the experiment was to terminate in wholesale destruction. Even as concerns wood itself, it is important to know how wood behaves when behind armor, as compared with its application to unprotected parts of the ship. First, can shells carry fire through armor so as to ignite wood inside it? Secondly, can wood be rendered non-inflammable by any composition without drowning it with water? Thirdly, what is the incendiary power of powder compared with lyddite? Fourthly, what is the poisonous effect of the gas generated by lyddite or similar high explosive? Then we should have wished that a casemate could have been constructed, and the liability of gas elsewhere to enter tried. For all these it would be necessary to fire single rounds and examine closely. If this is thought tedious, it might have been conducted by specialists only, without interfering with the operation of general destruction at the end, if desirable. In short, we hoped that much experience in detail was going to be obtained from this grand target, for in speaking of the incendiary power of common shell we have only dealt with one branch of the subject. There is a question of the penetrable action of the shells, of their behavior when burst by a quick fuse before they are broken by the shock of impact, compared with that of a fuse which allows the shell to be broken and then burn its powder after rupture, effects which were brought out by the Shannon experiments. The extraordinary breaking up into minute fragments of Palliser shells, which is liable to happen, as in air-space targets, has never been satisfactorily explained. Above all, we have always hoped for a trial of a powerful projectile passing through the decreased belt armor now adopted and impinging on the inclined deck armor behind it. What is likely to happen on deck above? This would call for a section to be specially made, and no doubt such a section might be made on shore; but when we are testing the effect of fire on ships' structures with an actual ship, it seems worth while operating a little more, and testing the question of structure as far as possible.

We are bound to admit, however, that not only are we completely in the dark, but that some statements add to the depth of that darkness. For example we are told: "Some 9-inch Krupp plates had been temporarily placed over the citadel and were fired at by the 6-inch guns. Though these were tested none were penetrated. The trial, therefore, demonstrated the value of the armor now in use." This could not be seriously said, and yet if this sentence was put forth to convey the impression to our continental powers that we are idiots, we think it is overdone, for we might just as well throw snowballs at Krupp 9-inch plates as 6-inch common shells, or for the matter of that 6-inch projectiles of any kind under service conditions. We imagine that the 9-inch Krupp plates were more likely to be intended to try what the 12-inch projectiles would do against them, 9-inch hard-faced plates constituting the vertical armor belt of the Majestic herself and her class, reinforced by inclined deck armor. If this, however, were intended, why was not the 12-inch gun fired so as to hit the 9-inch plate? We mean, why was not a deliberate experiment arranged, as we have said above, to test the belt?

In short, while we believe in our construction officers and our ordnance officers, and while we do not doubt that valuable results must be obtained from the Belleisle trial, at the present moment the question, like the vessel herself, may be described as enveloped in the thickest smoke.

## FROM WOODEN TO STEEL BARGES.

The Pittsburg Commercial Gazette is authority for the statement that the Monongahela Consolidated Coal & Coke Co. has opened negotiations for the erection of a plant at Pittsburg to be used in the building of steel barges for river service. The company intends to replace its wooden barges with steel ones. The company at present controls 1,400 coal barges. According to one of the directors the changes from wood to steel will be made gradually. About forty barges are to be built within the next twelve months. It is estimated that to replace the 1,400 craft now in service would cost \$4,200,000. The site of the plant will probably be at Webster on the Monongahela river. It is understood that the Carnegie Steel Co., the Riter & Conley Co. and the Shultz Iron Bridge Co. have been asked to bid.

The first of a fleet of ten sailing vessels which the Moran Bros. Co. of Seattle, Wash., is building for Capt. E. E. Caine and Charles Nelson of San Francisco is all in frame. The vessel will be pushed to completion with all possible speed and placed in the Hawaiian trade, running between Seattle, Honolulu and Hilo. She will be a four-master, built on modern lines, and her builders expect that she will develop as great speed as any sailing ship on the Pacific. Her general dimensions are: Length 207 feet 6 inches; beam 41 feet; depth of hold 14 feet 8 inches. She will have a carrying capacity of 1,800 tons. The contract price for the new schooner is \$52,000.

The Nickel Plate road will sell excursion tickets for the 4th of July at one fare for the round trip, within a radius of 200 miles, good going July 3 and 4 and returning until the 5th inclusive. Write, wire, 'phone or call on nearest agent, C. A. Asterlin, T. P. A., Ft. Wayne, Ind., or E. A. Akers, C. P. & T. A., Cleveland, O.



## TRADE NOTES.

The Foster Engineering Co. of Newark, N. J., has just made shipment of a large number of their reducing valves to the Maryland Steel Co. for use on the United States torpedo boat destroyers Truxtun, Whipple and Worden. The aggregate weight of these valves is over three tons.

Lane & De Groot, well known boat builders of Brooklyn, N. Y., recently turned out two fine launches of 23 and 40 feet length, respectively, with mahogany finish and brass trimmings. These launches will be furnished with gas engines. Lane & De Groot recently built two 28-foot life boats for the steamship Louisiana.

A circular from the Pelton Engineering Co. of Cleveland shows a list of hundreds of new and second hand machine tools which they can deliver immediately. "Our stock is continually changing," they say, "and if you do not find in our list what is wanted please write us. Parties having machinery for sale, or desiring an exchange for larger or more modern machines, will find it advantageous to communicate with us." The Pelton company makes a specialty of marine electric plants and general electric supplies.

The Northumberland Forge of Wallsend-on-Tyne, England, asks the Review to announce to vessel interests in this country that they have appointed Mr. James Steele as representative in London and immediate neighborhood, for the sale of marine engine forgings and also that they have opened an office at No. 22 Billiter street, E. C. This concern keeps in stock a large number of forgings for propeller shafts, and also parts of crank shafts, which enables them to execute orders in the shortest possible time. They have special facilities for giving quick despatch of crank and propeller shafts for repair or breakdown jobs.

A branch office of the Magnolia Metal Co. has been opened in San Francisco. It will be under the management and control of Messrs. Chas. C. Moore & Co., engineers of San Francisco, who have branch houses at Los Angeles, Seattle and Honolulu, and with whom the Magnolia company recently signed a contract giving them the sole and exclusive agency for Magnolia Metal in the States of California, Oregon, Washington, Montana, Nevada, Idaho, Arizona, Utah and New Mexico, and the Hawaiian Islands. Messrs. Chas. C. Moore & Co. are well known throughout the western territory, and the connection will undoubtedly be a valuable one.

## MACHINES REDUCE SHIP YARD COSTS.

It would seem from a paper read by Mr. Beljankin, engineer in the Russian navy, before the St. Petersburg Society of Marine Engineers, that the wages of workmen in American ship yards are many times over what they are in Russia, and yet the men in American yards are able to do more work at less expense to their employers than the forces employed in the Russian yards. This is due largely, as the Russian naval officer explained, to the general introduction of pneumatic tools into American yards, and this is why manufacturers of pneumatic tools in this country, especially the Chicago Pneumatic Tool Co., are now finding a very large

market for their machines in Russia. Mr. Beljankin's paper dealt with the displacement of hand work by mechanical appliances in American ship yards. He had been in this country for about eighteen months studying the question.

"Pneumatic tools were not introduced all at once in America," he said, "but came into use gradually as they were found necessary, often in large numbers and for great varieties of work when the employers were forced to take extreme measures on account of strikes. In order not to be subjected to the unreasonable demands of labor unions, it became necessary to apply much time and great effort to the development of machines that might be operated by men of little experience—not skilled labor but rather the ordinary run of workmen. The strikes did much to develop pneumatic tools in the United States."

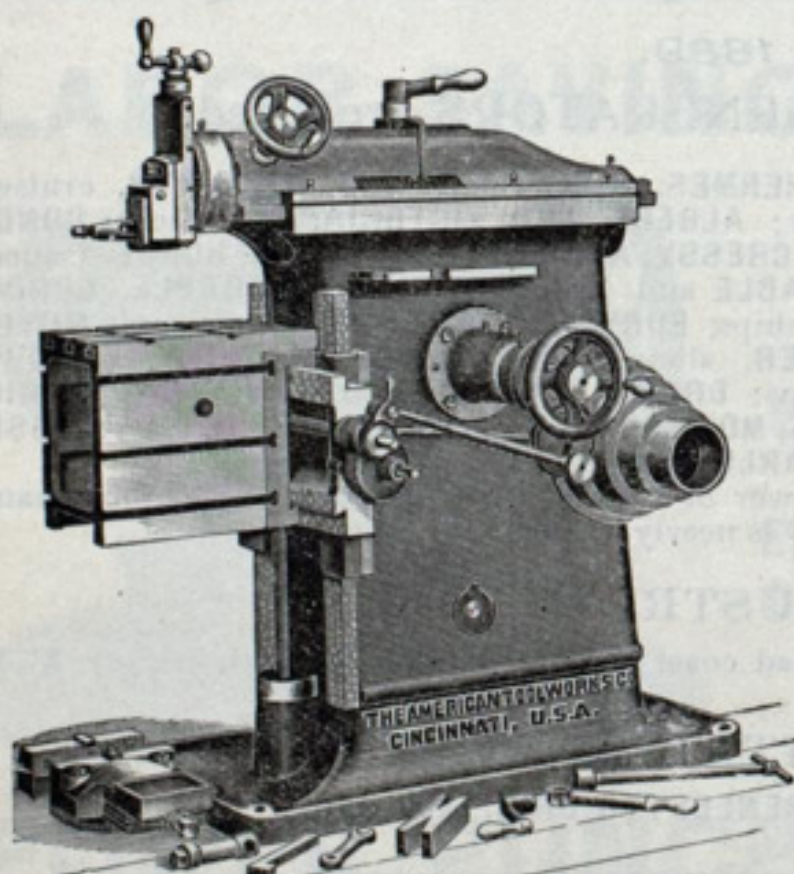
One feature of Mr. Beljankin's paper was a very interesting table on the comparative cost of driving 100 rivets in Russia and in this country. In Russia a riveter gets 42½ cents compared with \$2 and upward paid to American riveters. Mr. Beljankin says that as far as calking, drilling and chipping is concerned there is very little if any such work done by hand in America. "Thus it may be stated," he adds, "that calking to the extent of 280 feet may be performed by one man in America, while one of our workmen will do probably not more than 20 feet. For the 280 feet the American workman gets \$4.40, while we would have to pay for the same amount of work about \$14, and instead of one workman we would employ probably fourteen on the job. The same proportion applies to drilling and chipping."

The International Navigation Co., controlling the American and Red Star lines, has issued an attractive ruler containing the agate and nonpareil type measurements. On the reverse side it has a picture of the naval arch in New York and one of the company's steamers in mid-ocean.

## VALUE OF STOCKS—LEADING IRON AND STEEL INDUSTRIALS.

Quotations furnished by HERBERT WRIGHT & Co., Cleveland, date of June 13, 1900.

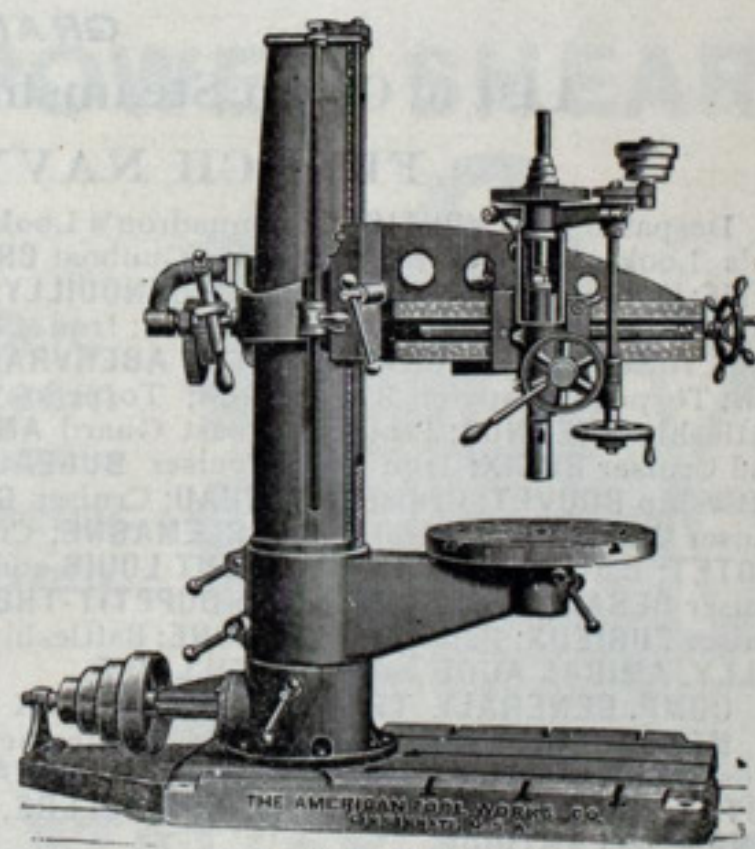
NAME OF STOCK.	OPEN	HIGH	LOW	CLOSE
American Steel & Wire.....	34¼	34¾	34¼	34¾
American Steel & Wire, Pfd.....	75½	75½	74¾	74¾
Federal Steel .....	31¾	33¼	31¾	33
Federal Steel, Pfd.....	66	66¾	66	66¾
National Steel .....	27½	27½	27½	27½
National Steel, Pfd.....	.....	.....	.....	.....
American Tin Plate .....	22	.....	.....	22
American Tin Plate, Pfd.....	73	.....	.....	73
American Steel Hoop.....	21	21	20¾	20¾
American Steel Hoop, Pfd.....	70¼	70¼	70½	70½
Republic Iron & Steel .....	11	11¾	11	11
Republic Iron & Steel, Pfd.....	56½	.....	.....	56½



New 16'' Back Geared Crank Shaper.

# Machine Tools

LATHES, PLANERS, SHAPERS,  
BORING and TURNING MILLS,  
UPRIGHT and RADIAL DRILLS,  
SCREW MACHINES,  
PULLEY LATHES,  
BOLT CUTTERS, Etc.



3' Radial Drill.

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PHILADELPHIA: The Fairbanks Co.

CLEVELAND: The Strong, Carlisle & Hammond Co.

BOSTON STORE: 36 Federal Street.

BALTIMORE: The Fairbanks Co.

SAN FRANCISCO: Henshaw, Bulkley & Co.

DENVER AND SALT LAKE CITY: The Mine & Smelter  
Supply Co.

LONDON: Alfred Herbert, Ltd., 7 Leonard St.,  
Finsbury, E. C.

DÜSSELDORF: de Fries & Co., Act. Ges.,  
Graf Adolf Strasse, 83-87

ANTWERP: Nyssens Freres, 33 Rue des Peignes.

BERLIN: de Fries & Co., Act. Ges.,  
Kloster Strasse, 13-15.

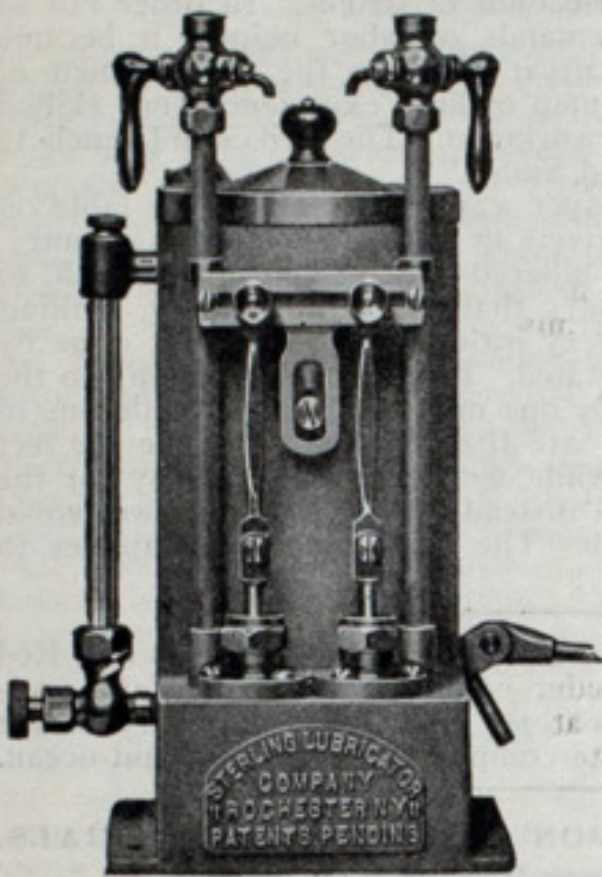
PARIS: Roux Freres & Cie., 54 Boulevard  
du Temple.

MOSCOW: Alfred Stucken.



**STERLING FORCE FEED LUBRICATOR.**

The Sterling force-feed lubricator, recently put upon the market by the Sterling Lubricator Co. of Rochester, N. Y., is meeting with wonderful success. These lubricators are of the automatic force-feed variety, taking their motion from the valve gear of the engine or other movable part. They are very attractive and are made in quart, half-gallon, gallon and two-gallon sizes, and in single, double, triple and quadruple feeds,



thus giving large reservoir capacity and feeding oil into single, compound, triple and four cylinder engines. This is done with the greatest accuracy and reliability, as there is an independent oil pump for each feed, each adjusted independently of the other so as to feed from one to twenty drops of oil to each stroke of the oil pump. The number of strokes of the pump per minute is controlled by a locking cam plate upon the rear of the lubricator, and can be instantly changed from one tooth upon the ratchet wheel to each revolution of the engine to as many teeth as may be required, thus increasing or diminishing the number of discharges of oil into the cylinder as may be needed. The amount of oil delivered by each oil pump is regulated on the rocker arms upon the front of the lubricator. It will be seen that the lubricator has two distinct motions, one for speed and one for quantity. All of these adjustments may be made while the

lubricator is in full motion without danger to the fingers of the engineer or of injury in any way to the lubricator. A hand attachment permits of the operation of the pumps independently of the engine and without changing any of its adjustments, either when the engine is at rest or when in full motion, as is sometimes necessary when some entrained water is passing through the valves and causing the engine to groan and cut. Engineers will appreciate this attachment and acknowledge its utility.

These machines are manufactured with great care without any regard to cost or trouble and are full nickel plated. The policy of the company is to turn out nothing but first-class goods, and the wisdom of this is fully demonstrated by the large and increasing sale of these lubricators. In recent years it has been proven that the use of steam under high pressure and in large units required something more than the old-fashioned tallow cups or the unreliable sight feed lubricators so extensively sold in

the past. Beside a saving of from 35 to 50 per cent. of the oil required by the old methods of cylinder lubrication, it is claimed that by feeding minute quantities of oil into the cylinders and valves at frequent intervals the friction is reduced to a minimum, thereby increasing the durability and efficiency of the engine with a lower consumption of fuel and lower cost for repairs.

**STEAMER CHRISTOPHER COLUMBUS.**

Changes made by the Goodrich Transportation Co. during the past winter in the whaleback passenger steamer Christopher Columbus are thus described in one of the Chicago papers:

"Important changes to the steamer Christopher Columbus, of the Goodrich line, since the closing of navigation last year make her not only the largest excursion steamer in the world, but the most conveniently arranged. A promenade deck with an open space of 7204 square feet and seating capacity for 2673 people has been made possible by the addition of an upper or lifeboat deck, which removes all of the necessary life saving paraphernalia and appliances out of the way of the passengers and puts them where they are accessible only to the officers and crew, acting under the same strict discipline as is maintained on ocean steamers. In addition to giving the passengers more room and comfort, the appearance of the vessel has been greatly improved by the additions. Another improvement that the passengers will appreciate is the addition of gentlemen's and ladies' lavatories and toilet rooms on the upper deck. These adjoin the barber shop, which is also located immediately below the lifeboat deck. Despite the additional room afforded the passengers, the company will not apply for any addition to her carrying capacity. This will stand at 4000 people, as last year. Perfect comfort, with every opportunity to enjoy every feature of a lake trip, is the object sought in the work accomplished during last winter. The steamship Christopher Columbus is unique in that she is the only passenger ship of her kind ever constructed. She was built expressly for the World's Fair service, and is regarded as the safest and speediest excursion boat afloat. Her hull is of steel, 362 feet long, 42 feet beam and 24 feet in depth. Her speed, without forcing, is twenty-one miles per hour. Six steel Scotch boilers, 11 by 12 feet, furnish the triple expansion engines with their power."

A steel dock costing about \$50,000 will be erected at Fort Caswell on the North California coast. The amount appropriated for the work is \$150,000.

Summer outings.—Before deciding when and where to spend a portion of the hot season this year, send for the booklet issued by the Nickel Plate road, entitled "Summer Outings," including many picturesque points on the south shore of Lake Erie and the classic shores of Lake Chautauqua. Sent to any address upon application to B. F. Horner, general passenger agent, Cleveland, O. No. 101, July 6.

# BELLEVILLE GENERATORS.

GRAND PRIZE AT THE WORLD'S FAIR OF 1889.

List of Ocean Steamships on Board which BELLEVILLE GENERATORS are Used.

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Despatch Boat **VOLTIGEUR**; Squadron's Look-out Ship **MILAN**; Squadron's Look-out Ship **HIRONDELLE**; Gunboat **CROCODILE**; Despatch Boat **ACTIF**; Cruiser **AMIRAL RIGAUD DE GENOUILLY**; Iron Clad Cruiser **ALGER**; Iron Clad Cruiser **LATOUCHE-TREVILLE**; Iron Clad Cruiser **CHANZY**; Iron Clad Cruiser **AMIRAL CHARNER**; Tug **ABERVACH**; Despatch Boat **CAUDAN**; Torpedo Despatch Boat **LEGER**; Torpedo Despatch Boat **LEVRIER**; Battleship **BRENNUS**; Protected Coast Guard **AMIRAL TREHOUART**; Iron Clad Cruiser **BRUIX**; Iron Clad Cruiser **BUGEAUD**; Cruiser **DESCARTES**; Battleship **BOUVET**; Cruiser **POTHUAU**; Cruiser **GALILEE**; Cruiser **PASCAL**; Cruiser **CATINAT**; Battleship **CHARLEMAGNE**; Cruiser **LAVOISIER**; Cruiser **PROTET**; Battleships **GAULOIS**, **SAINT LOUIS** and **HOCHE**; Iron Clad **IENA**; Cruiser **DESAIX**; Iron Clad Cruiser **DUPETIT-THOUARS**; Cruiser **DUPLEIX**; Cruiser **FURIEUX**; Battleship **NEPTUNE**; Battleship **DEVASTATION**; Cruisers **SULLY**, **AMIRAL AUBE** and **MARSEILLAISE**.

COMP. GENERALE TRANSATLANTIQUE: X (type Caen) **LAQUEBOT**.

MESSAGERIES MARITIMES: Cargo Steamer **ORTEGAL**; Mail Steamships **SINDH**, **AUSTRALIEN**, **POLYNESIEN**, **ARMAND-BEHIC**, **VILLE-DE-LACIOTAT**, **ERNEST-SIMONS**, **CHILI**, **CORDILLERE**, **LAOS**, **INDUS**, **TONKIN**, **ANNAM**, **ATLANTIQUE**.

COMPAGNIE DES CHEMINS DE FER DE L'OUEST, (Plying between Dieppe and Newhaven): Freight Steamers **ANGERS**, **CAEN**, **BREST**, **CHERBOURG**; Fast Steamers **TAMISE**, **MANCHE**, **FRANCE**.

**RUSSIAN NAVY.**

Iron Clad Frigate **MININE**; Gunboat **GROZIATCHY**; Imperial Yacht **MAREVO**; Imperial Yacht **STRELA**; Gunboat **GREMIASCHY**; Gunboat **OTVAJNI**; Imperial Yacht **TZAREWNA**; Imperial Yacht **STANDARD**; Cruiser **ROSSYA**; School Ship **VERNY**; Cruiser **SVETLANA**; Cruiser **DIANA**; Cruiser **PULLADA**; Torpedo Transport Boat **BAKAN**; **KHERSON** and **MOSKBA**; Ships of the Volunteer Fleet; Gunboat **GILACH**; Iron Clad **EKATERINA II**; Gunboat **KOUBANETZ**; Cruiser **AURORA**; Iron Clad **EMPEREUR NICOLAS I**; Iron Clad **PRINCE POTIEMKINE DE TAURIDE**; Cruiser **BAYAN**; Iron Clad **CESAREWITCH**; Gunboats **TERETZ** and **OURALETZ**; Iron Clad **BORODINOW**; **SMOLENSK**; Ship of the Russian volunteer fleet; cruiser **BOJARINE**; Iron Clad **SINOPE**.

**ENGLISH NAVY.**

Torpedo Boat Destroyer **SHARPSHOOTER**; **POWERFUL** and **TERRIBLE**, iron clad cruisers; **GLADIATOR**, **ARROGANT**, **FURIOUS**, **VINDICTIVE**, cruisers; **NIOBE**, **DIADEM**, **ANDROMEDA**, **EUROPA**, cruisers; **CANOPUS**, **GLORY**, **GOLIATH**, **ALBION**, **OCEAN**, iron clad ships; **ARGONAUT**, **ARIADNE**, **AMPHI-**

**TRITE**, **SPARTIATE**, **HERMES**, **HIGHFLYER** and **HYACINTH**, cruisers; **VENGEANCE**, iron clad; **ALBERT AND VICTORIA**, royal yacht; **CONDOR** and **ROSARIO**, sloops; **CRESSY**, **ABOUKIR**, **SUTLEY** and **HOGUE**, cruisers; **IMPLACABLE**, **FORMIDABLE** and **IRRESISTIBLE**, **VENERABLE**, **LONDON**, **BULWARK**, iron clad ships; **EURYALUS**, **BACHANTE**, cruisers; **MUTINE**, **RINALDO**, **SHEARWATER**, sloops; **CORNWALLIS**, **DUNCAN**, **EXMOUTH**, **RUSSEL**, iron clad ships; **DRAKE**, **KING ALFRED**, **LEVIATHAN**, **AFRICA**, cruisers; **VESTAL**, sloop; **MONMOUTH**, cruiser; **BEDFORD**, cruiser; **ESSEX**, **KENT**, cruisers; **ALBEMARLE**, **MONTAGUE**, battleships.

The total horse power of boilers fitted on board the 57 above named ships of the British navy is nearly 900,000.

**AUSTRIAN NAVY.**

**BUDA-PEST**, iron clad coast guard; **KAISER KARL VI**, cruiser; **X'**, **X''**, battleships

**ITALIAN NAVY.**

**VARESE**, cruiser; **BENEDETTO BRIN**, battleship.

**ARGENTINE REPUBLIC.**

**PUEYRREDON**, cruiser; Steamships **PUERTO-HUERGO** and **MENDOZA**.

**SPANISH NAVY.**

**REINA REGENTE**, cruiser.

**CHILIAN NAVY.**

**O'HIGGINS**, cruiser; **ALMIRATE LYNCH**, torpedo boat destroyer; **ALMIRANTE CONDELL**, torpedo boat destroyer; **GENERAL BAQUEDANO**, school ship.

**JAPANESE NAVY.**

**SHIKISHIMA**, iron clad; **CHIYODA**, cruiser; **ASAHI**, iron clad; **IWATE**, cruiser; **AZUMA**, cruiser; **HATSUSE**, iron clad; **ITSUKUSHIMA**, iron clad coast guard; **MIKASA**, battleship; **TZUMO**, cruiser.

**UNITED STATES OF AMERICA.**

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General Information Sent on Demand.



## ALONG THE ATLANTIC COAST.

It is proposed to launch the six-masted wood schooner building at Camden, Me., on the Fourth of July with a big celebration. The Camden people say that their schooner will be bigger than that building at Bath, just as their five-master, the John B. Prescott, beat the Bath five-master Nathaniel T. Palmer by 5 tons in size, 2,249 to 2,244 net. Both schooners are designed to carry 5,200 tons dead weight.

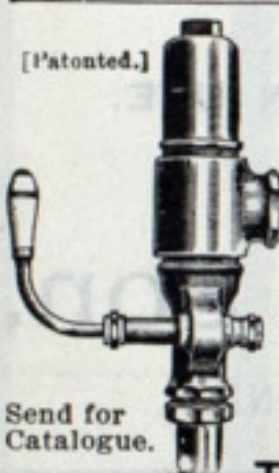
A dispatch from Mobile, Ala., says that the Munson Steamship line has contracted with the Mobile & Ohio Railroad Co. to absorb the Mobile & Cuban Steamship Co., which since the Spanish war has done a successful trade from Mobile. It is stated that the Munson company will put on a line of steamers out of Mobile to a number of other ports in the islands and in South America and Mexico.

The Brewer Dry Dock Co., with principal offices at No. 320 Marshall street, Elizabeth, N. J., was incorporated at Trenton, N. J., on May 31. The object of the new company is to build and operate dry docks. Capital \$30,000. Incorporators: Everard C. Brewer, George A. Benton and Thomas H. Benton.

The big four-masted schooner at William Rogers' yard, Bath, Me., is ceiled. A gang of eighteen men performed the work in ten days. This is said to be the quickest job ever done in a Bath yard. The vessel is of 1,500 tons. The men averaged a strake and four planks on the inside a day.

The Hamburg-American Company announces that on Oct. 1 next a service will be established from New York to Hayti, the United States of Columbia, Port Limon and Jamaica, the company dispatching a steamer every ten days.

At the annual meeting of the International Navigation Co., Philadelphia, the following directors were re-elected: Clement A. Griscom, William H. Barnes, Francis L. Potts, Samuel F. Houston and James F. Swartz.



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## NAVAL MATTERS.

A cruise to European waters, which will include trips to both the Mediterranean and French ports, has been arranged for the training ship Hartford, recently arrived at Hampton Roads from the Pacific coast with a large crew of landsmen on board. The ship is now at League Island. The forthcoming cruise of the Hartford is the first she will have taken to a foreign station since the early days of her career. She will return home during the latter part of August.

Lieut. Theodore Cornell Fenton, assistant chief of ordnance, United States navy, has graduated from Columbian University with the degree of mechanical engineer. He entered the naval academy as a cadet engineer. On graduation he was commissioned in the line. The degrees of L. L. B. and L. S. M. were obtained from Columbian University after the usual course of studies and examinations.

Naval Instructor Albert W. Stahl of the Norfolk navy yard is quoted as saying that the department under his control at that yard at the present time is probably as well fitted for miscellaneous work as any yard on the Atlantic coast. The installation of new and improved machinery and the elimination of the political boss have done much in the rehabilitation of this fine yard.

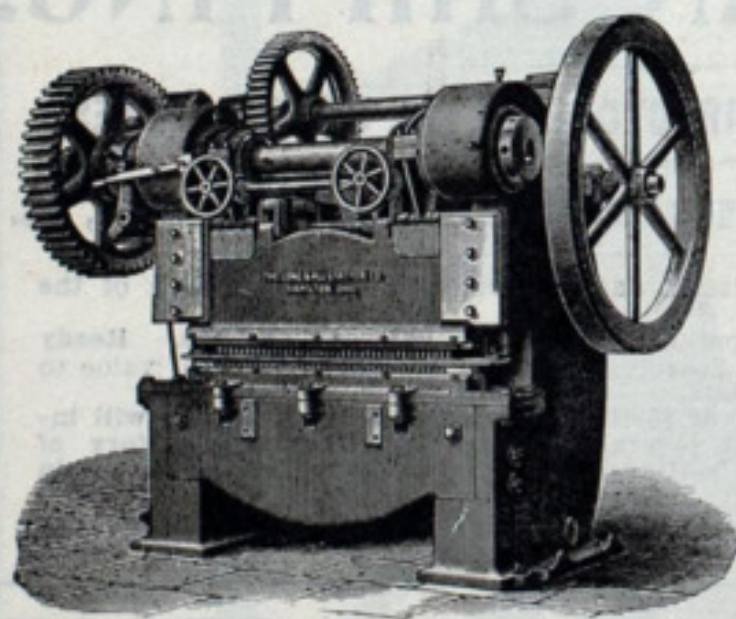
A magnificent silver service was presented to the battleship Kentucky last week by citizens of Kentucky at Hampton Roads. The service is the most costly ever given to an American fighting ship and consists of seventy pieces of beautifully wrought silver.

Change of time on the Nickel Plate road.—No. 1 leaves Buffalo at 1:00 a. m. and departs from intermediate stations about one hour later than formerly; No. 5 leaves Buffalo at 12:50 p. m. and is due at intermediate stations about 40 minutes later than formerly; No. 4 leaves Chicago at 3:30 p. m. and is due at intermediate stations about 30 minutes later than the winter schedule. Only a slight change in the other trains at any of our stations. Improvement in sleeping car service both east and west. Individual club breakfasts, luncheons or suppers served in dining cars. Write, wire, 'phone or call on E. A. Akers, C. P. & T. A., Cleveland, O., or C. A. Asterlin, T. P. A., Ft. Wayne, Ind. 95, June 15

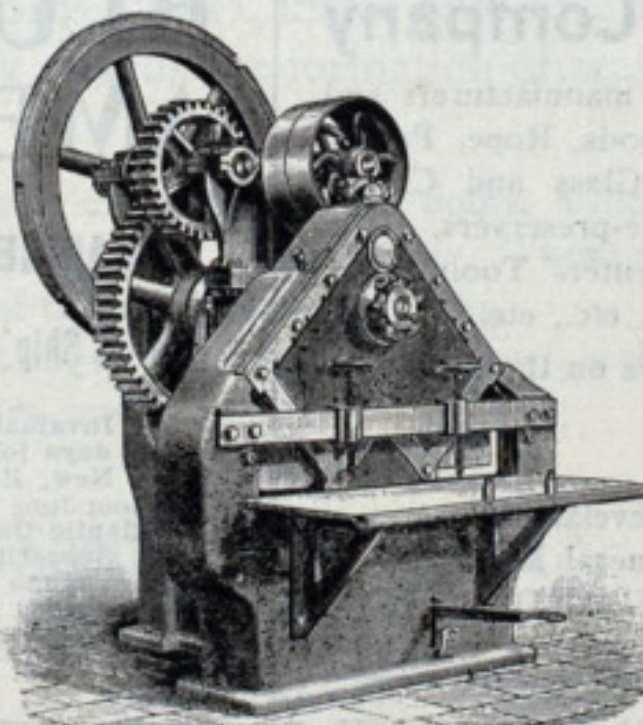
U. S. Engineer Office, Vicksburg, Miss., May 28, 1900. Sealed proposals for excavating 7,500,000 cubic yards of earth, more or less, along route for diverting mouth of Yazoo River, near Vicksburg, Miss., will be received here until 3 o'clock, p. m., June 28, 1900, and then publicly opened. Information furnished on application. Thos. L. Casey, Major, Engrs. June 21.

U. S. Engineer Office, Galveston, Tex., May 30, 1900. Sealed bids in triplicate, for improving Galveston Ship Channel and Buffalo Bayou, Tex., by dredging, etc., will be received until 2 p. m., June 30, 1900, and then publicly opened. For information apply to C. S. Riche, Capt., Engrs. June 21.

## LABOR SAVING.....

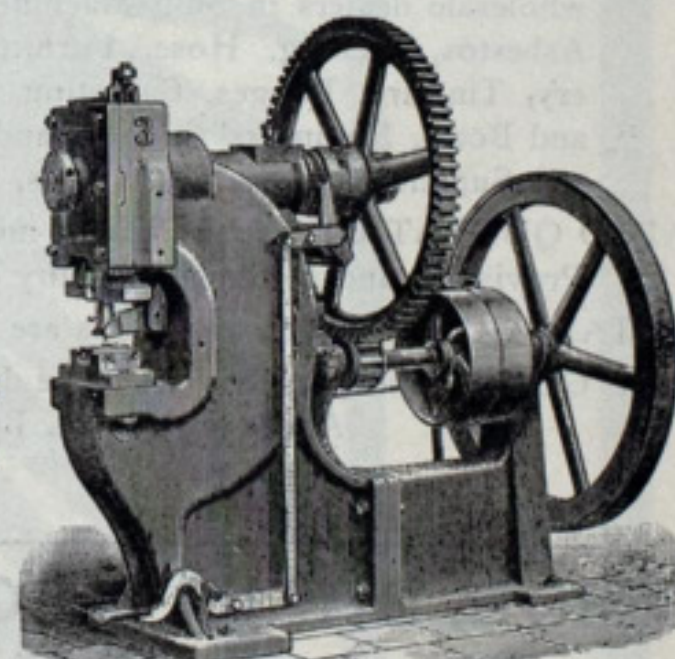


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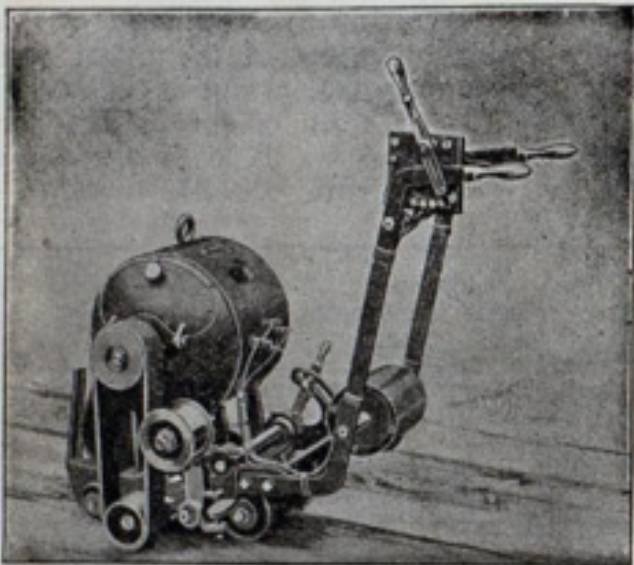


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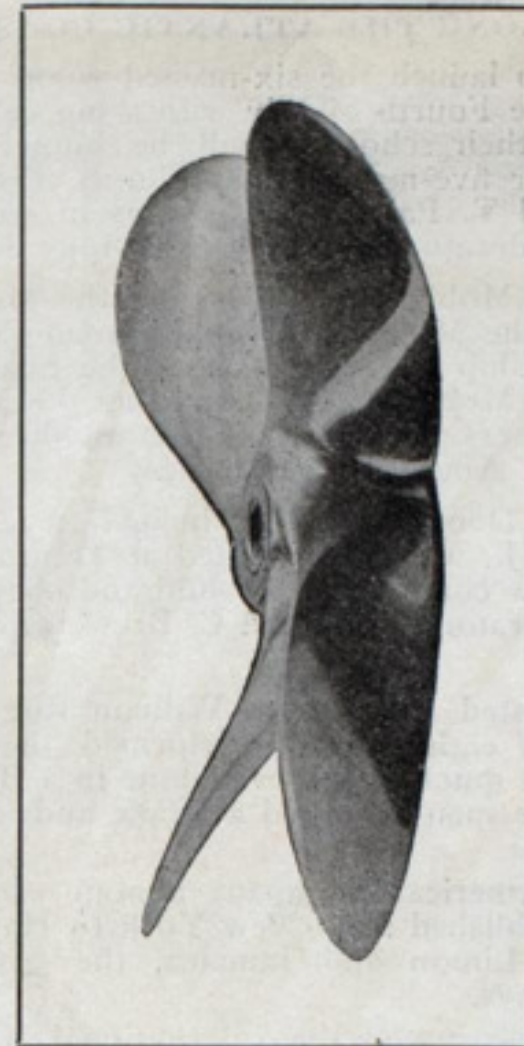


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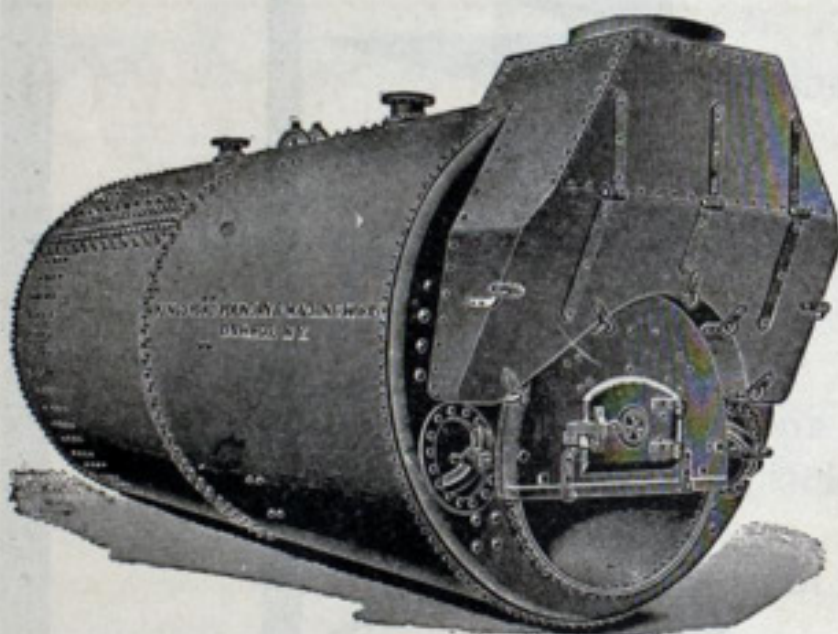


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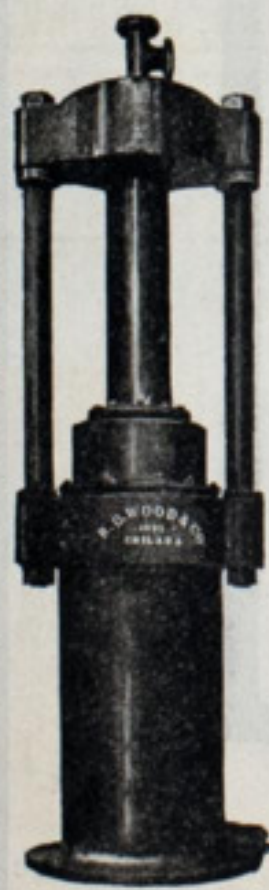
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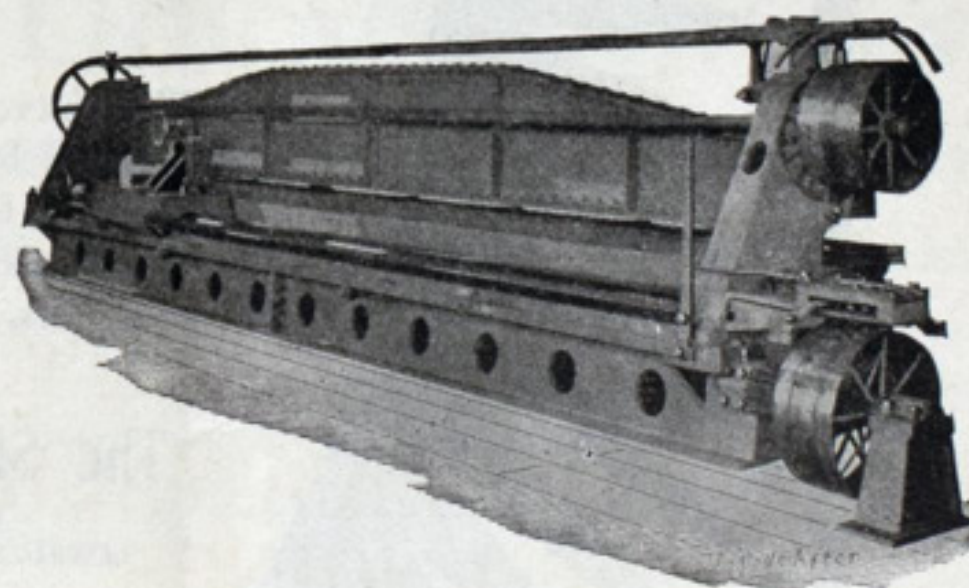


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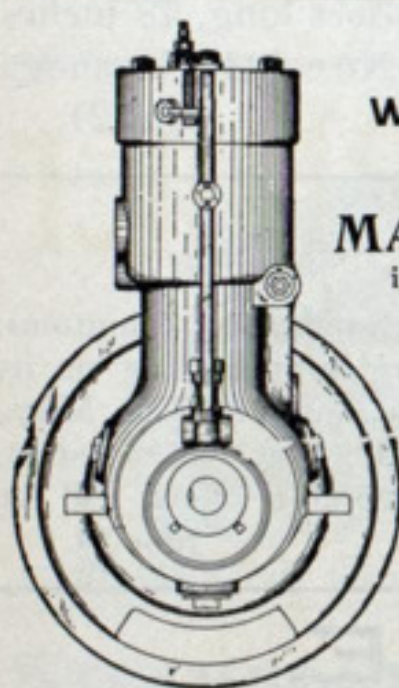
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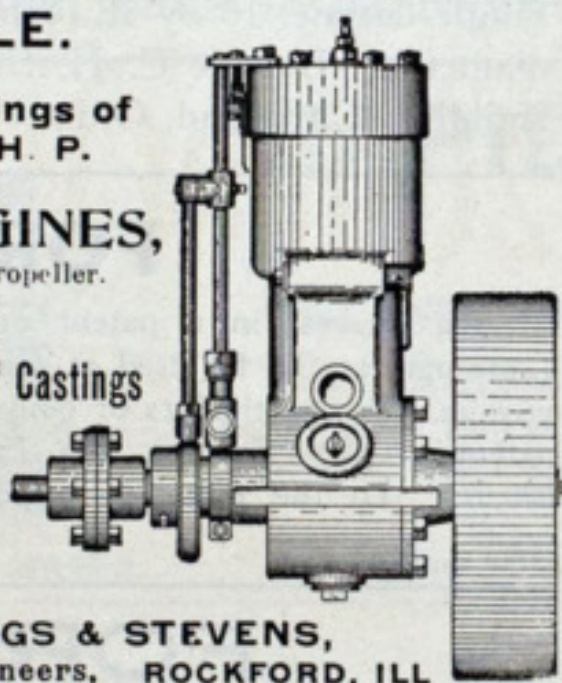
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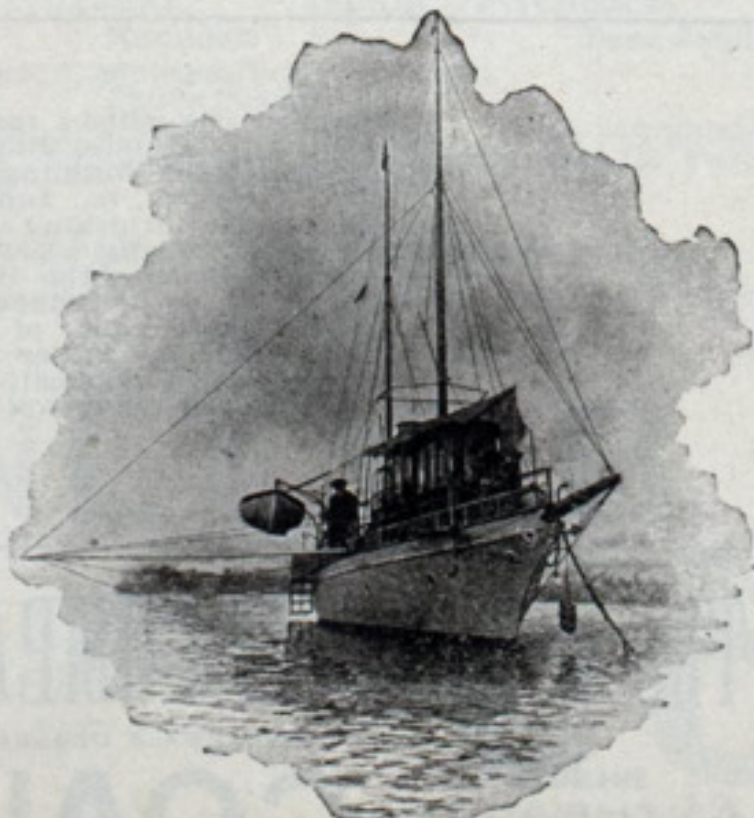
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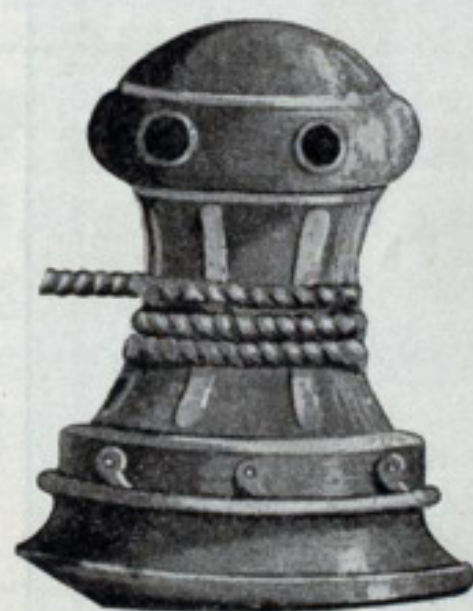
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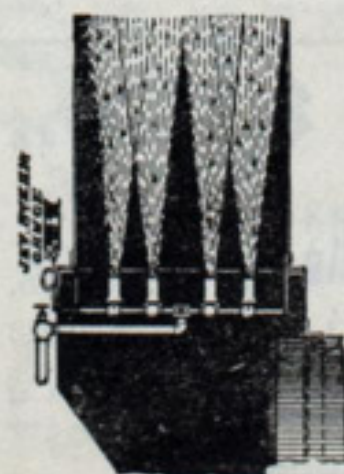
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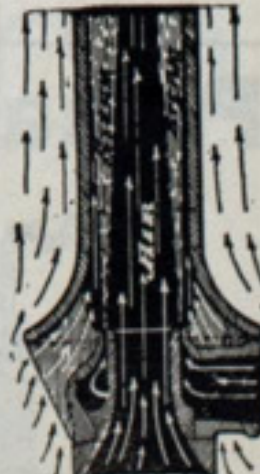


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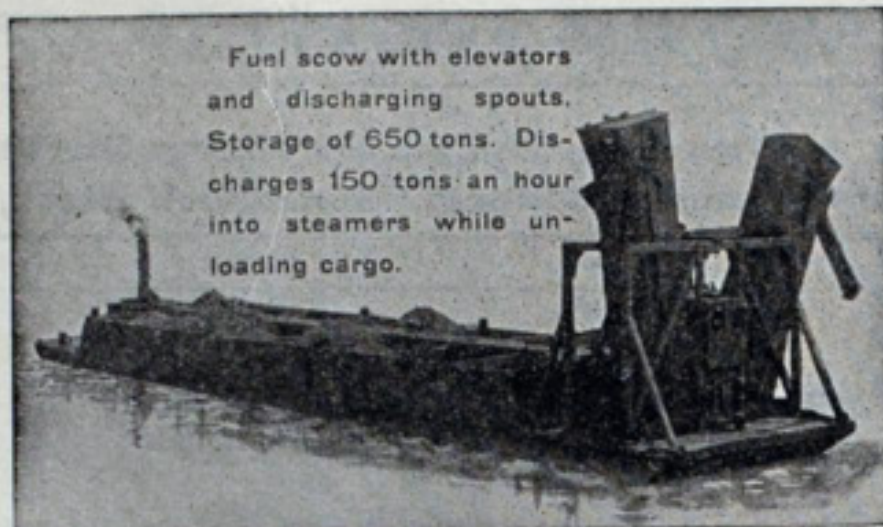
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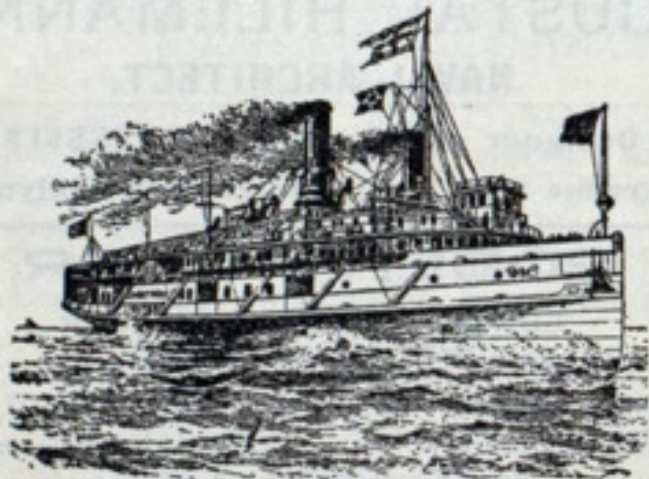
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- MACHINISTS' AND DRAFTSMEN'S HAND BOOK—Peder Lobben. A reference book for all interested in mechanical work. \$2.50.
- MARINE ENGINEERS—Constantine. Just out. \$2.50.
- ENGINES AND ENGINE RUNNING—Joshua Rose. For the use of those who desire to pass an examination to take charge of an engine or boiler; illustrated. \$2.50.
- SMALL ENGINES AND BOILERS—Egbert P. Watson. A manual of concise and specific directions for construction of small steam engines and boilers of modern types; illustrated. \$1.25.
- DRAWING AND DESIGNING FOR MARINE ENGINEERS—Chas. W. Roberts. \$3.
- MARINE ENGINES—R. Murray. \$1.80.
- MARINE BOILERS—L. E. Bertin. 250 illustrations, designs and tables. \$7.50.
- MARINE BOILERS—Triplex. \$1.
- REED'S MARINE BOILERS—H. T. Davis. Second edition, revised and enlarged. \$2.
- BOILERS: MARINE AND LAND—T. W. Traill. For the use of engineers, surveyors, draughtsmen and steam users. \$5.
- MARINE ENGINEERS' RECORD BOOK—Bartley C. Bryan. Designed to contain a complete record of all the parts of a set of marine engines, auxiliary engines, pumps, etc. \$2.
- MECHANICAL ENGINEERS' POCKET BOOK—Wm. Kent. Reference book of rules, tables, etc. \$5.
- RESISTANCE AND PROPULSION OF SHIPS—W. F. Durand, principal of school of marine construction, Cornell University. \$5.



## BUYERS' DIRECTORY OF THE MARINE TRADE.

For a more complete classification than that represented by advertisers in the Marine Review, see the BLUE BOOK OF AMERICAN SHIPPING, marine and naval directory of the United States, published by the Marine Review Pub. Co., 418-419 Perry-Payne Bldg., Cleveland.

See accompanying Index of Advertisers for full addresses of concerns in this directory.

### AIR COMPRESSORS, AIR HOISTS, ETC.

Chicago Pneumatic Tool Co.....Chicago.  
Ingersoll-Sergeant Drill Co.....New York.  
Philadelphia Pneumatic Tool Co.....Philadelphia.

### ANCHORS.

Baldt Anchor Co.....Chester, Pa.  
International Anchor Co.....Cleveland.

### ANTI-FRICTION METALS.

Cramp, Wm. & Sons.....Philadelphia.  
Illinois Smelting & Refining Works.....Chicago.  
Magnolia Metal Co.....New York.  
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.

### ARTIFICIAL DRAFT FOR BOILERS.

American Ship Building Co.....Cleveland.  
Bloomsburg & Co., H.....Newport News, Va.  
Buffalo Forge Co.....Buffalo.  
Detroit Shipbuilding Co.....Detroit.  
Sprague Electric Co.....New York.  
Sturtevant, B. F. Co.....Boston.

### ATTORNEYS AND PROCTORS IN ADMIRALTY.

Crowl, Samuel H.....Cleveland.  
Gilchrist, Albert J.....Cleveland.  
Goulder, Harvey D.....Cleveland.  
Hoyt, Dustin & Kelley.....Cleveland.  
Pinney, Orestes C.....Cleveland.  
White, Johnson, McCaslin & Cannon.....Cleveland.

### AXLES, SOLID AND HOLLOW.

Bethlehem Steel Co.....So. Bethlehem, Pa.

### BABBITT METAL.

Cramp, Wm. & Sons.....Philadelphia.  
Illinois Smelting & Refining Works.....Chicago.  
Magnolia Metal Co.....New York.  
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.

### BAROMETERS, MARINE GLASSES, ETC.

Bliss, John & Co.....New York.  
Ritchie, E. S. & Sons.....Brookline, Mass.

### BENDING AND STRAIGHTENING ROLLS.

Cleveland Punch & Shear Works Co.....Cleveland.  
Long & Allstatter Co.....Hamilton, O.  
New Doty Mfg. Co.....Janesville, Wis.

### BLOCKS, SHEAVES, ETC.

Boston & Lockport Block Co.....Boston, Mass.  
Cleveland Block Co.....Cleveland.  
Donohue & Co., John T.....Baltimore.

### BLOWERS.

Buffalo Forge Co.....Buffalo.  
Sprague Electric Co.....New York.  
Sturtevant, B. F. Co.....Boston.

### BOAT NAILS AND SPIKES.

American Steel & Wire Co.....Chicago.

### BOAT BUILDERS.

Dreln, Thos. & Son.....Wilmington, Del.  
Electric Boat Co.....New York.  
Gas Engine & Power Co. and Chas. L. Seabury  
& Co., Consolidated.....New York.  
Lane & DeGroot.....Brooklyn.

### BOILER MANUFACTURERS.

Almy Water Tube Boiler Co.....Providence, R. I.  
American Ship Building Co.....Cleveland.  
Atlantic Works.....East Boston, Mass.  
Babcock & Wilcox Co.....New York.  
Bath Iron Works, Ltd.....Bath, Me.  
Boyer Water Tube Boiler Co.....New York.  
Chicago Ship Building Co.....Chicago.  
Cramp, Wm. & Sons.....Philadelphia.  
Dearing Water Tube Boiler Co.....Detroit.  
Delaunay, Belleville & Co.....St. Denis, France.  
Detroit Screw Works.....Detroit.  
Detroit Shipbuilding Co.....Detroit.  
Farrar & Trefts.....Buffalo.  
Fletcher, W. & A. Co.....Hoboken, N. J.  
Fore River Engine Co.....Weymouth, Mass.  
Gas Engine & Power Co.....Morris Heights, N. Y.  
Hardy, John B.....Tacoma, Wash.  
Harlan & Hollingsworth Co.....Wilmington, Del.  
Hodge, S. F. & Co.....Detroit.  
Iowa Iron Works.....Dubuque, Ia.  
Jenks Ship Building Co.....Port Huron, Mich.  
Kingsford Found'y & Machine Works.....Oswego, N. Y.  
MacKinnon Mfg. Co.....Bay City, Mich.  
Maryland Steel Co.....Sparrow's Point, Md.  
Moran Bros. Co.....Seattle, Wash.  
Morse Iron Works & Dry Dock Co.....Brooklyn.  
Neafie & Levy Ship & Eng. Bldg. Co.....Philadelphia.  
Newport News Ship Bldg. Co.....Newport News, Va.  
Nixon, Lewis.....Elizabeth, N. J.  
Pusey & Jones Co.....Wilmington, Del.  
Risdon Iron Works.....San Francisco.  
Roberts Safety Water Tube Boiler Co.....New York.  
Stirling, The Co.....Chicago.  
Trigg, Wm. R. Co.....Richmond, Va.  
Union Iron Works.....San Francisco.  
Wolff & Zwicker Iron Works.....Portland, Ore.

### BOILER COMPOUNDS.

Dearborn Drug & Chemical Works.....Chicago.

### BOILER COMPOUND FEEDER.

Hall Compound Feeder Co.....Chicago.

### BOILER TUBES, SEAMLESS, WELDLESS.

Atlantic Tube Co.....Pittsburg.  
Shelby Steel Tube Co.....Cleveland.

### BOILER FURNACES, FIRE FRONTS, ETC.

Continental Iron Works.....New York.

### BOILER RIVETS.

Bourne Fuller Co.....Cleveland.  
Champion Rivet Co.....Cleveland.

### BOILER STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.

Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

### BOLT CUTTERS.

American Tool Works Co. (The).....Cincinnati.

### BORING AND TURNING MILLS.

American Tool Works Co. (The).....Cincinnati.  
Bement, Miles & Co.....Philadelphia.

### BRASS AND BRONZE CASTINGS.

Cramp, Wm. & Sons.....Philadelphia.  
Illinois Smelting & Refining Works.....Chicago.  
Phosphor Bronze Smelting Co.....Philadelphia.

### BRASS AND COPPER SHEET, ROD, WIRE AND TUBES.

Hungerford Brass & Copper Co., U. T.....New York.

### BRIDGES, BUILDERS OF.

Berlin Iron Bridge Co.....East Berlin, Conn.  
Scherzer Rolling Lift Bridge Co.....Chicago.

### BUCKETS, ORE AND COAL.

Brown Holsting & Conveying Mach. Co.....Cleveland.  
McMyler Mfg. Co.....Cleveland.  
Webster, Camp & Lane Machine Co.....Akron, O.

### CABIN AND CABINET FINISHING WOODS.

Martin-Barriss Co.....Cleveland.

### CAPSTANS.

American Ship Windlass Co.....Providence, R. I.  
Hyde Windlass Co.....Bath, Me.

### CHAINS.

Lebanon Chain Works.....Lebanon, Pa.  
Monongahela Iron & Steel Co.....Pittsburg.  
Newhall Chain Forge & Iron Co.....New York.  
Standard Chain Co.....Pittsburg.

### CHAIN HOISTS.

Boston & Lockport Block Co.....Boston, Mass.

### CHUCKING MACHINES.

American Tool Works Co. (The).....Cincinnati.

### CIRCULATOR EQUILIBRIUM, with Steam Heating Attachment.

Bloomsburg & Co., H.....Newport News, Va.

### CLOCKS (Marine), CHRONOMETERS, BELLS.

Ashton Valve Co.....Boston.  
Bliss, John & Co.....New York.  
Chelsea Clock Co.....Boston.  
Ritchie, E. S. & Sons.....Brookline, Mass.

### COAL PRODUCERS AND SHIPPERS.

Castner, Curran & Bullitt.....Philadelphia.  
Hanna, M. A. & Co.....Cleveland.  
Pickands, Mather & Co.....Cleveland.  
Pittsburg Coal Co.....Cleveland.  
Rochester & Pittsburgh Coal & Iron Co.....Buffalo.  
Scott Co., W. L.....Erie, Pa.

### COAL AND ORE HANDLING MACHINERY.

Brown Holsting & Conveying Mach. Co.....Cleveland.  
Lidgerwood Mfg. Co.....New York.  
McMyler Mfg. Co.....Cleveland.

### COMPASSES.

Bliss, John & Co.....New York.  
Ritchie, E. S. & Sons.....Brookline, Mass.

### COMPASS ADJUSTER.

Simpson, Geo. A.....Sault Ste. Marie, Mich.

### COPPER SHEET, WIRE AND ROD.

Hungerford Brass & Copper Co., U. T.....New York.

### CORK JACKETS AND RINGS.

Armstrong Cork Co.....Pittsburgh, Pa.  
Kahnweiler's Sons, D.....New York.  
Lane & DeGroot.....Brooklyn.

### CRANES, CONVEYORS, HOISTS.

Brown Holsting & Conveying Mach. Co.....Cleveland.  
Donohue & Co., John T.....Baltimore.  
General Electric Co.....Schenectady, N. Y.  
Lidgerwood Mfg. Co.....New York.  
McMyler Mfg. Co.....Cleveland.  
Sprague Electric Co.....New York.  
Westinghouse Electric & Mfg. Co.....Pittsburg.

### CRANK PINS.

Bethlehem Steel Co.....Bethlehem, So. Pa.

### DECK PLANING MACHINERY.

Dallett, Thos. H. & Co.....Philadelphia.

### DECK SEAMS, COMPOSITION FOR.

Cole & Kuhls.....Brooklyn, N. Y.

### DRILLS—ROCK DRILLS, COAL CUTTERS, ETC.

Ingersoll-Sergeant Drill Co.....New York.

### DRILL PRESSES—DRILLS OF ALL KINDS.

American Tool Works Co. (The).....Cincinnati.  
Bement, Miles & Co.....Philadelphia.  
Cleveland Punch & Shear Works Co.....Cleveland.

### DRILLS, PNEUMATIC.

Chicago Pneumatic Tool Co.....Chicago.  
Philadelphia Pneumatic Tool Co.....Philadelphia.  
Standard Pneumatic Tool Co.....Chicago.

### DRYING APPARATUS.

Sturtevant Co., B. F.....Boston.

### DRY DOCKS.

American Ship Building Co.....Cleveland.  
Bath Iron Works, Ltd.....Bath, Me.  
Buffalo Dry Dock Co.....Buffalo.  
Chicago Ship Building Co.....Chicago.  
Craig Ship Building Co.....Toledo, O.  
Cramp, Wm. & Sons.....Philadelphia.  
Detroit Shipbuilding Co.....Detroit.  
Harlan & Hollingsworth Co.....Wilmington, Del.  
Maryland Steel Co.....Sparrow's Point, Md.  
Moran Bros. Co.....Seattle, Wash.  
Morse Iron Works & Dry Dock Co.....Brooklyn.  
Newport News Ship Bldg Co.....Newport News, Va.  
Nixon, Lewis.....Elizabeth, N. J.  
Pusey & Jones Co.....Wilmington, Del.  
Townsend & Downey Ship Bldg. Co.....New York.  
Union Dry Dock Co.....Buffalo.  
Union Iron Works.....San Francisco.

### ELEVATORS.

Morse, Williams & Co.....Philadelphia.

### ELECTRIC AUTOMATIC WHISTLE OPERATORS.

Signal & Control Co.....New York.

### ELECTRIC LIGHT AND POWER PLANTS.

Buffalo Forge Co.....Buffalo.  
Elwell-Parker Electric Co.....Cleveland.  
General Electric Co.....Schenectady, N. Y.  
Pelton Engineering Co.....Cleveland.  
Sprague Electric Co.....New York.  
Sturtevant, B. F. Co.....Boston.  
Westinghouse Electric & Mfg. Co.....Pittsburgh, Pa.

### ELECTRIC HOISTS AND CRANES.

Elwell-Parker Electric Co.....Cleveland.  
General Electric Co.....Schenectady, N. Y.  
Lidgerwood Mfg. Co.....New York.  
Sprague Electric Co.....New York.  
Westinghouse Electric & Mfg. Co.....Pittsburgh, Pa.

### ENGINE BUILDERS, MARINE.

American Ship Building Co.....Cleveland.  
Atlantic Works.....East Boston, Mass.  
Bath Iron Works, Ltd.....Bath, Me.  
Chicago Ship Building Co.....Chicago.  
Chase Machine Co.....Cleveland.  
Craig Ship Building Co.....Toledo, O.  
Cramp, Wm. & Sons.....Philadelphia.  
Detroit Shipbuilding Co.....Detroit.  
Farrar & Trefts.....Buffalo.  
Fletcher, W. & A. Co.....Hoboken, N. J.  
Fore River Engine Co.....Weymouth, Mass.  
Gas Engine & Power Co., and Chas. L. Seabury  
& Co., Consolidated.....New York.  
Giddings & Stevens.....Rockford, Ill.  
Hardy, John B.....Tacoma, Wash.  
Harlan & Hollingsworth Co.....Wilmington, Del.  
Hodge, S. F. & Co.....Detroit.  
Iowa Iron Works.....Dubuque, Ia.  
Jenks Ship Building Co.....Port Huron, Mich.  
MacKinnon Mfg. Co.....Bay City, Mich.  
Maryland Steel Co.....Sparrow's Point, Md.  
Moran Bros. Co.....Seattle, Wash.  
Morse Iron Works & Dry Dock Co.....Brooklyn.  
Neafie & Levy Ship & Eng. Bldg. Co.....Philadelphia.  
Newport News Ship Bldg Co.....Newport News, Va.  
Nixon, Lewis.....Elizabeth, N. J.  
Pusey & Jones Co.....Wilmington, Del.  
Risdon Iron Works.....San Francisco.  
Roach's Ship Yard.....Chester, Pa.  
Sheriffs Mfg. Co.....Milwaukee.  
Trigg, Wm. R. Co.....Richmond, Va.  
Trout, H. G.....Buffalo.  
Union Iron Works.....San Francisco.  
Wolff & Zwicker Iron Works.....Portland, Ore.

### ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.

Cory, Chas. & Son.....New York.

### ENGINEERS, MARINE AND MECHANICAL.

Giddings & Stevens.....Rockford, Ill.  
Hillman, Gustav.....Brooklyn.  
Hunt, Robt. W. & Co.....Chicago.  
Miller, Walter.....Cleveland.  
Pittsburgh Testing Laboratory, Ltd.....Pittsburgh.  
Powell, Ambrose V.....Chicago.  
See, Horace.....New York.  
Simpson, W. L.....5th and Buttonwood, Philadelphia.  
Wood, W. J.....Chicago.

### FANS FOR VENTILATION, EXHAUST, ETC.

Buffalo Forge Co.....Buffalo.  
Sprague Electric Co.....New York.  
Sturtevant, B. F. Co.....Boston.

### FEED WATER PURIFIERS AND HEATERS.

Learmonth, Robert.....Buffalo.  
Warren Webster & Co.....Camden, N. J.  
Keystone Engine & Machine Works, W. L. Simpson,  
Engineer.....Philadelphia.

### FORGES.

Buffalo Forge Co.....Buffalo.  
Sturtevant Co., B. F.....Boston.

### FORGINGS, IRON AND STEEL.

Bethlehem Steel Co.....South Bethlehem.  
Bourne-Fuller Co.....Cleveland.

### FIXTURES FOR LAMPS, OIL AND ELECTRIC.

Page Bros. & Co.....Boston.



## BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

## FLUSHOMETERS.

Kenney, The Co.....New York.

## FURNACES FOR BOILERS.

Continental Iron Works.....New York.

## FUELING COMPANIES AND COAL DEALERS.

Castner, Curran &amp; Bullitt (Pocahontas).....

.....Philadelphia.

Graham, James &amp; Co.....Detroit.

Hanna, M. A. &amp; Co.....Cleveland.

Pickands, Mather &amp; Co.....Cleveland.

Pittsburg Coal Co.....Cleveland.

Rochester &amp; Pittsburgh Coal &amp; Iron Co.....Buffalo.

Smith, Stanley B. &amp; Co.....Detroit.

Scott Co., W. L.....Erie, Pa.

Youghiogheny &amp; Lehigh Coal Co.....Chicago.

## GAS BUOYS.

Safety Car Heating &amp; Lighting Co.....New York.

## GAS AND GASOLINE ENGINES.

Giddings &amp; Stevens.....Rockford, Ill.

McMyler Mfg. Co.....Cleveland.

Olds Motor Works.....Detroit.

## GAGES, STEAM AND VACUUM.

American Steam Gauge Co.....Boston.

Ashton Valve Co.....Boston.

Crosby Steam Gage &amp; Valve Co.....Boston.

## GRAPHITE.

Dixon Crucible Co., Joseph.....Jersey City, N. J.

## HAMMERS, PNEUMATIC.

Chicago Pneumatic Tool Co.....Chicago.

Philadelphia Pneumatic Tool Co.....Philadelphia.

Standard Pneumatic Tool Co.....Chicago.

## HAMMERS, POWER DROP.

Bement, Miles &amp; Co.....Philadelphia.

Chase Machine Co.....Cleveland.

## HAWSERS, WIRE.

American Steel &amp; Wire Co.....Chicago.

## HEATING APPARATUS.

Sturtevant Co., B. F.....Boston.

## HOISTS FOR CARGO, ETC.

American Ship Building Co.....Cleveland.

Brown Hoisting &amp; Conveying Mach. Co.....Cleveland.

Chase Machine Co.....Cleveland.

Donohue &amp; Co., John T.....Baltimore.

Elwell-Parker Electric Co.....Cleveland.

General Electric Co.....New York.

Hodge, S. F. &amp; Co.....Detroit.

Hyde Windlass Co.....Bath, Me.

Lidgerwood Mfg. Co.....New York.

McMyler Mfg. Co.....Cleveland.

Marine Iron Co.....Bay City.

Sprague Electric Co.....New York.

Westinghouse Electric &amp; Mfg. Co.....Pittsburg.

## INDICATORS FOR STEAM ENGINES.

American Steam Gauge Co.....Boston.

Ashton Valve Co.....Boston.

Crosby Steam Gage &amp; Valve Co.....Boston.

## INJECTORS.

Jenkins Bros.....New York.

Penberthy Injector Co.....Detroit.

## INSURANCE, MARINE.

Brown &amp; Co.....Buffalo.

Drake &amp; Maytham.....Buffalo.

Elphicke, C. W. &amp; Co.....Chicago.

Gibbs &amp; Joys.....Milwaukee.

Hawgood &amp; Moore.....Cleveland.

Helm, D. T. &amp; Co.....Duluth, Minn.

Hutchinson &amp; Co.....Cleveland.

Keith, J. G. &amp; Co.....Chicago.

La Salle &amp; Co.....Duluth.

Mitchell &amp; Co.....Cleveland.

Osborn &amp; Co., F. H.....Chicago.

Pauly, H. J.....Milwaukee.

Parker &amp; Millen.....Detroit.

Peck, Chas. E. &amp; W. F.....New York and Chicago.

Richardson, W. C.....Cleveland.

## IRON ORE AND PIG IRON.

Bourne-Fuller Co.....Cleveland.

Hanna, M. A. &amp; Co.....Cleveland.

Pickands, Mather &amp; Co.....Cleveland.

## IRON OR STEEL STAYBOLTS, HOLLOW OR SOLID.

Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

## LATHES OF ALL KINDS.

American Tool Works Co. (The).....Cincinnati.

Bement, Miles &amp; Co.....Philadelphia.

## LAUNCHES—NAPHTHA, ELECTRIC.

Electric Boat Co.....New York.

Gas Engine &amp; Power Co.....New York.

## LIFE PRESERVERS, LIFE BOATS, BUOYS, RAFTS, ETC.

Armstrong Cork Co.....Pittsburg.

Dreln, Thos. &amp; Son.....Wilmington, Del.

Kahnweiler's Sons, D.....New York.

Lane &amp; DeGroot.....Brooklyn.

## LIGHTS, SIDE AND SIGNAL.

Page Bros. &amp; Co.....Boston.

## LUBRICATING PUMPS.

Manzel Bros.....Buffalo.

Phenix Metallic Packing Co.....Chicago.

Sterling Lubricator Co.....Rochester, N. Y.

## MACHINE TOOLS.

American Tool Works Co. (The).....Cincinnati.

Bement, Miles &amp; Co.....Philadelphia.

Pelton Engineering Co.....Cleveland.

## MACHINE TOOLS (WOOD WORKING).

Egan Co., The.....Cincinnati.

Fay, J. A. &amp; Co.....Cincinnati.

Woods Machine Co., S. A.....So. Boston.

## MATTRESSES, CUSHIONS, BEDDING.

Fogg, M. W.....New York.

Mechanical Fabric Co.....Providence, R. I.

## METALLIC PACKING.

Katzenstein, L. &amp; Co.....New York.

Phenix Metallic Packing Co.....Chicago.

U. S. Metallic Packing Co.....Philadelphia.

## METALS FOR BEARINGS.

Cramp, Wm. &amp; Sons.....Philadelphia.

Illinois Smelting &amp; Refining Works.....Chicago.

Magnolia Metal Co.....New York.

Phosphor Bronze Smelting Co., Ltd.....Philadelphia.

## METAL POLISH.

Bertram's Oil Polish Co.....Boston, Mass.

## MILLING MACHINES OF ALL KINDS.

American Tool Works Co. (The).....Cincinnati.

Bement, Miles &amp; Co.....Philadelphia.

## NAUTICAL INSTRUMENTS.

Bliss, John &amp; Co.....New York.

Ritchie &amp; Sons, E. S.....Brookline, Mass.

## NAVAL ARCHITECTS.

Curr, Robert.....Cleveland.

Hillman, Gustav.....Brooklyn.

See, Horace.....New York.

Wood, W. J.....Chicago.

## NICKEL STEEL FORGINGS.

Bethlehem Steel Co.....So. Bethlehem, Pa.

## OILS AND LUBRICANTS.

Dixon Crucible Co., Jos.....Jersey City, N. J.

Standard Oil Co.....Cleveland.

## PACKING.

Jenkins Bros.....New York.

Katzenstein, L. &amp; Co.....New York.

Phenix Metallic Packing Co.....Chicago.

U. S. Metallic Packing Co.....Philadelphia.

## PAINTS.

Baker, Howard H. &amp; Co.....Buffalo.

Smith, Edward &amp; Co.....New York.

Upson-Walton Co.....Cleveland.

## PAINTING MACHINES, PNEUMATIC.

Chicago Pneumatic Tool Co.....Chicago.

## PATENT ATTORNEYS.

Thurston &amp; Bates.....Cleveland.

## PATTERN SHOP MACHINERY.

Egan Co., The.....Cincinnati.

Fay, J. A. &amp; Co.....Cincinnati.

Woods Machine Co., S. A.....So. Boston.

## PIPE, WROUGHT IRON.

Bourne-Fuller Co.....Cleveland.

## PLANERS OF ALL KINDS.

American Tool Works Co. (The).....Cincinnati.

Bement, Miles &amp; Co.....Philadelphia.

## PLANING MILL MACHINERY.

Egan Co., The.....Cincinnati.

Fay, J. A. &amp; Co.....Cincinnati.

Woods Machine Co., S. A.....So. Boston.

## PLUMBING, MARINE.

Ellis Marine Plumbing Co.....New York.

Mott Iron Works, J. L.....New York.

Sands, Alfred B. &amp; Son.....New York.

Kenney, The Co.....New York.

## PNEUMATIC TOOLS.

Chicago Pneumatic Tool Co.....Chicago.

Philadelphia Pneumatic Tool Co.....Philadelphia.

Standard Pneumatic Tool Co.....Chicago.

## POLISH FOR METALS.

Bertram's Oil Polish Co.....Boston, Mass.

## PROPELLER WHEELS.

American Ship Building Co.....Cleveland.

Atlantic Works.....East Boston, Mass.

Bath Iron Works Ltd.....Bath, Me.

Case, A. Wells &amp; Son.....Highland Park, Conn.

Cramp, Wm. &amp; Sons.....Philadelphia.

Detroit Shipbuilding Co.....Detroit.

Farrar &amp; Trefts.....Buffalo.

Fore River Engine Co.....Weymouth, Mass.

Hardy, John B.....Tacoma, Wash.

Harlan &amp; Hollingsworth Co.....Wilmington, Del.

Hodge, S. F. &amp; Co.....Detroit.

Jenks Ship Building Co.....Port Huron, Mich.

MacKinnon Mfg Co.....Bay City, Mich.

Maryland Steel Co.....Sparrow's Point, Md.

Moran Bros. Co.....Seattle, Wash.

Morse Iron Works &amp; Dry Dock Co.....Brooklyn.

Neafie &amp; Levy Ship &amp; Eng. Bldg. Co.....Philadelphia.

Newport News Ship Bldg. Co.....Newport News, Va.

Nixon, Lewis.....Elizabeth, N. J.

Phosphor Bronze Smelting Co., Ltd.....Philadelphia.

Pusey &amp; Jones Co.....Wilmington, Del.

Risdon Iron Works.....San Francisco.

Sheriffs Mfg. Co.....Milwaukee.

Trigg, Wm. R. Co.....Richmond, Va.

Trout, H. G.....Buffalo.

Union Iron Works.....San Francisco.

Wolff &amp; Zwicker Iron Works.....Portland, Ore.

## PROJECTORS, ELECTRIC.

Elwell-Parker Electric Co.....Cleveland.

General Electric Co.....Schenectady, N. Y.

Rushmore Dynamo Works.....Jersey City, N. J.

Sprague Electric Co.....New York.

Westinghouse Electric &amp; Mfg. Co.....Pittsburg, Pa.

## PUMPS FOR VARIOUS PURPOSES.

Blake, Geo. F. Mfg. Co.....New York.

Davidson, M. T.....Brooklyn, N. Y.

Donohue &amp; Co., John T.....Baltimore.

Kingsford Foundry &amp; Machine Works.....

.....Oswego, N. Y.

Van Duzen, The E. W. Co.....Cincinnati.

Worthington, Henry R.....New York.

## PUNCHES, RIVETERS, SHEARS.

American Tool Works Co. (The).....Cincinnati.

Bement, Miles &amp; Co.....Philadelphia.

Cleveland Punch &amp; Shear Works Co.....Cleveland.

Long &amp; Allstatter Co.....Cincinnati.

New Doty Mfg. Co.....Janesville, Wis.

Wood &amp; Co., R. D.....Philadelphia.

## REGISTER FOR CLASSIFICATION OF VESSELS.

Great Lakes Register.....Cleveland.

## RELEASING HOOKS FOR DETACHING BOATS.

Standard Aut. Releasing Hook Co.....New York.

## RIVETS, STEEL, FOR SHIPS AND BOILERS.

Bourne-Fuller Co.....Cleveland.

Champion Rivet Co.....Cleveland.

## RIGGING ROPE (WIRE).

American Steel &amp; Wire Co.....Chicago.

## RUBBER INSULATED WIRES.

Roebling's Sons, John A.....New York and Cleveland.

American Steel &amp; Wire Co.....Chicago.

## SAFETY VALVES.

American Steam Gauge Co.....Boston.

Ashton Valve Co.....Boston.

Crosby Steam Gage &amp; Valve Co.....Boston.

## SAIL MAKERS.

Baker, Howard H. &amp; Co.....Buffalo.

Upson-Walton Co.....Cleveland.

Wilson &amp; Silsby.....Boston.

## SALVAGE COMPANIES.

See wrecking companies.

## SCREW MACHINES.

American Tool Works Co. (The).....Cincinnati.

Bement, Miles &amp; Co.....Philadelphia.

## SEARCH LIGHTS.

Elwell-Parker Electric Co.....Cleveland.

General Electric Co.....Schenectady, N. Y.

Rushmore Dynamo Works.....Jersey City, N. J.

Sprague Electric Co.....New York.

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MAY 21, 1896	MAY 1, 1898
100,000	141,967
JUNE 1, 1892	JUNE 1, 1894
42,118	63,876
JUNE 1, 1890	
20,625	
JUNE 1, 1888	
6,124	
JUNE 5, 1886	
COMMENCED BUSINESS	

**MARCH 5, 1900  
200,000  
IN USE**

**PENBERTHY**

**EFFICIENCY 99 27/100 %  
LABORATORY TEST**

MAY 1, 1899	MAY 1, 1897
167,912	119,009
JUNE 1, 1895	JUNE 1, 1893
81,217	53,967
JUNE 1, 1891	
30,761	
JUNE 1, 1889	
11,478	
JUNE 1, 1887	
2503	
IN USE	

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No. 28, New York & Boston Express .....		*7 40 am	*8 00 am
No. 32, Fast Mail .....		*11 25 am	*11 30 am
No. 44, Accommodation, via Sandusky .....		†1 15 pm	
No. 46, Southwestern Express.....			*3 00 pm
No. 6, Limited Fast Mail .....		*5 40 pm	*5 45 pm
No. 10, Chicago, New York & Boston Special...		*7 35 pm	*7 40 pm
No. 16, New England Express.....		*10 30 pm	*10 35 pm
No. 2, Day Express .....		†9 05 pm	†9 20 pm
No. 126, Norwalk Accommodation .....		†7 55 am	
No. 40, Toledo & Buffalo Accom., via Norwalk.		†10 00 am	†10 30 am
No. 126, Norwalk Accommodation .....		†7 55 am	
No. 116, Conneaut Accommodation .....			†4 30 pm
Westward:—		Ar. fr. East.	Dep. West.
No. 11, Southwestern Limited.....		*3 25 am	
No. 15, New York, Boston & Chicago Special...		*3 05 am	*3 10 am
No. 21, New York & Chicago Express .....		*5 10 am	*5 20 am
No. 7, Day Express .....			†6 30 am
No. 19, The Lake Shore Limited .....		*7 35 am	*7 40 am
No. 23, Western Express .....		*11 10 am	*11 15 am
No. 33, Southwestern Express.....		*12 25 pm	
No. 133, United States Express.....			*12 40 pm
No. 47, Accommodation .....			†3 00 pm
No. 141, Sandusky Accommodation .....			†3 10 pm
No. 127, Norwalk Accommodation .....			†5 10 pm
No. 37, Pacific Express .....		*6 35 pm	*7 00 pm
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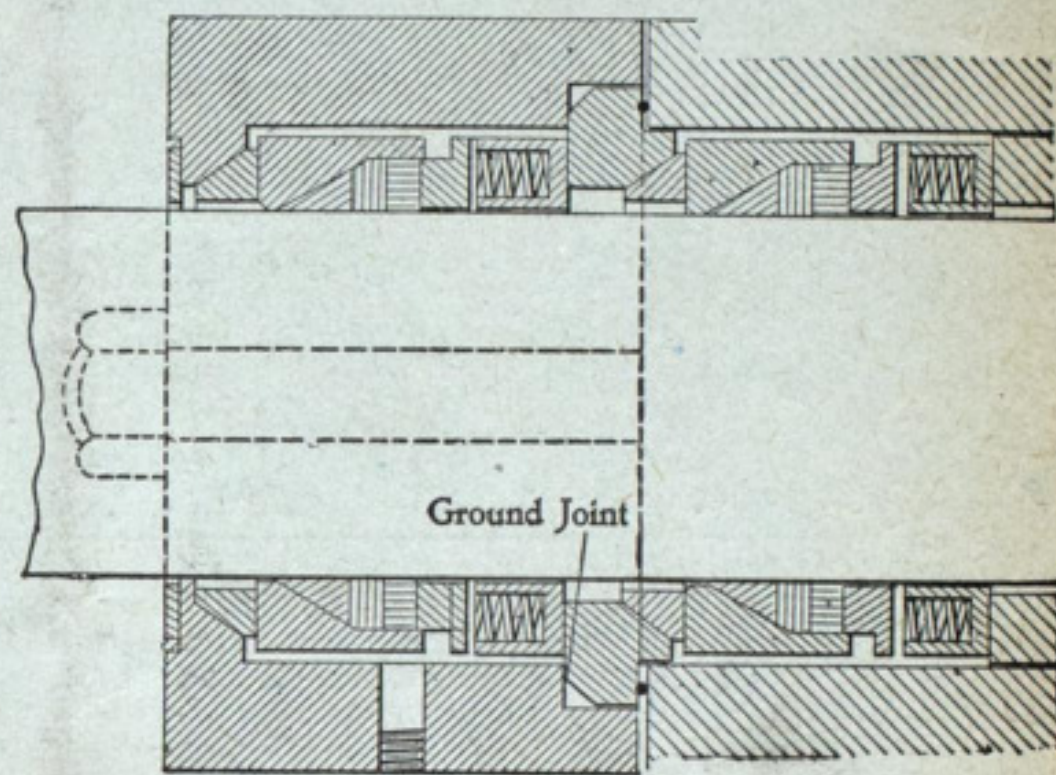
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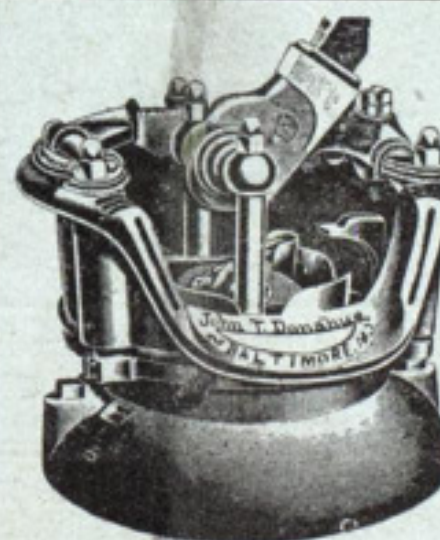
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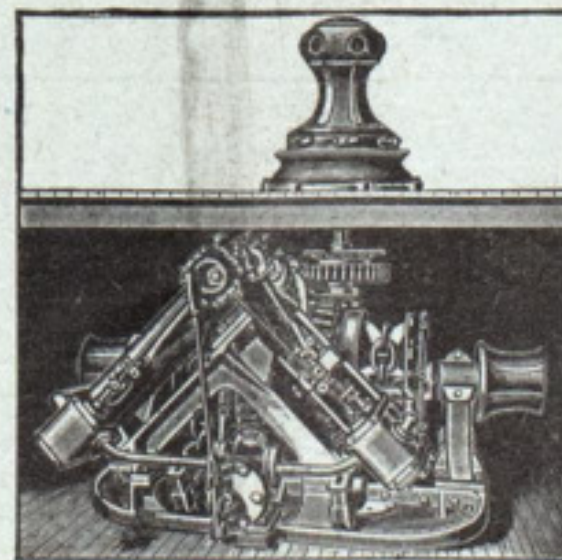
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No. 24



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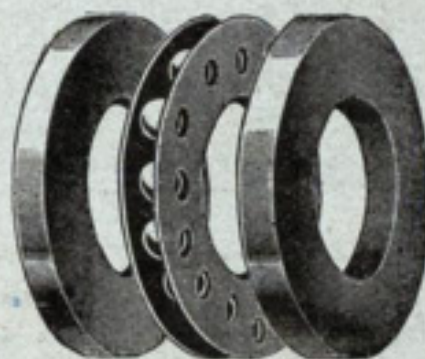
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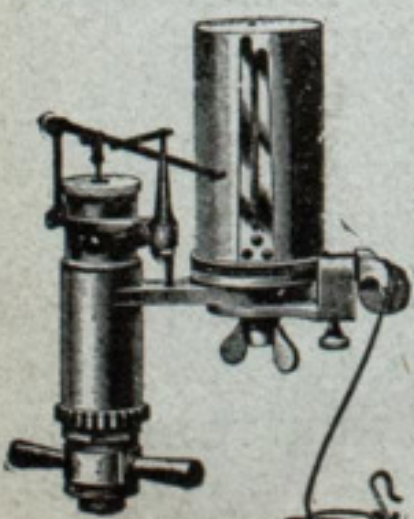
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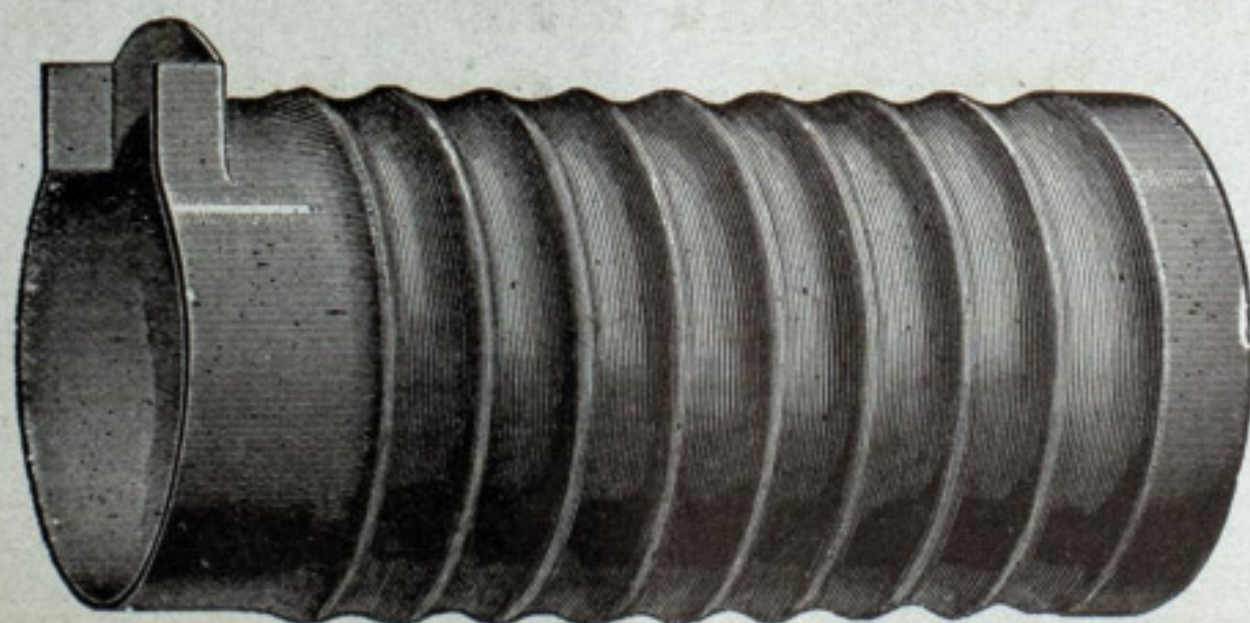
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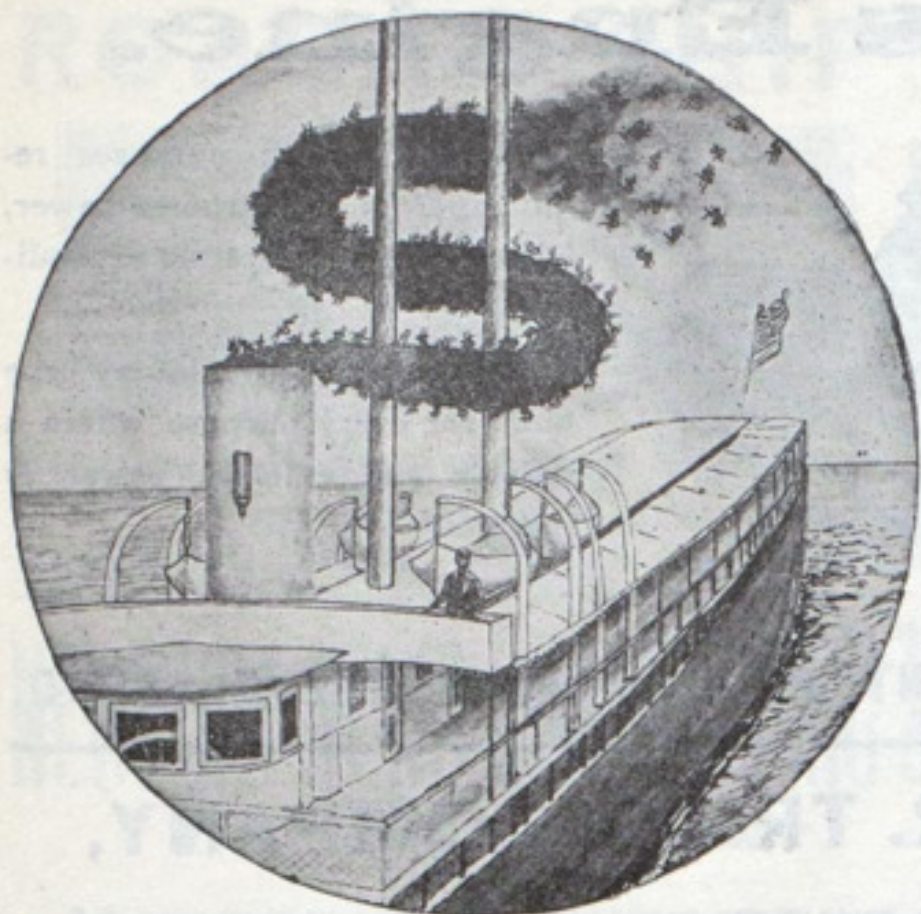
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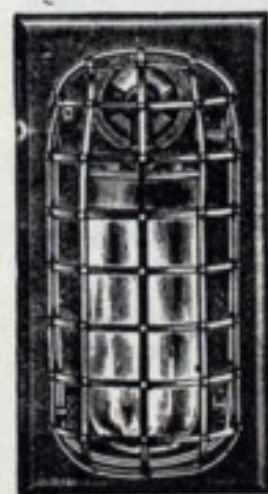
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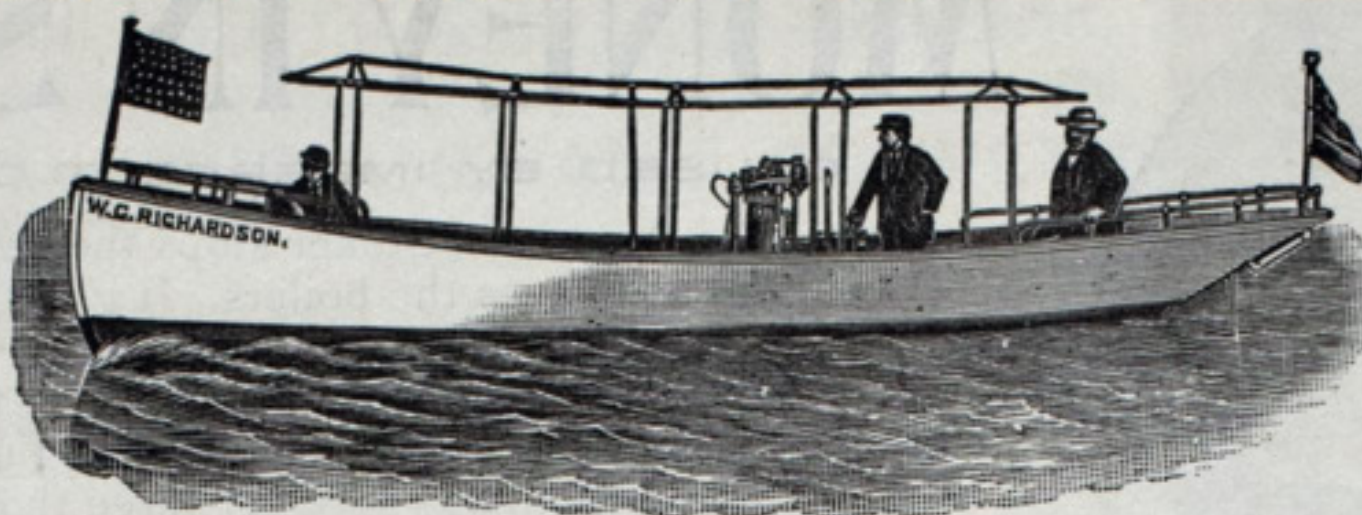


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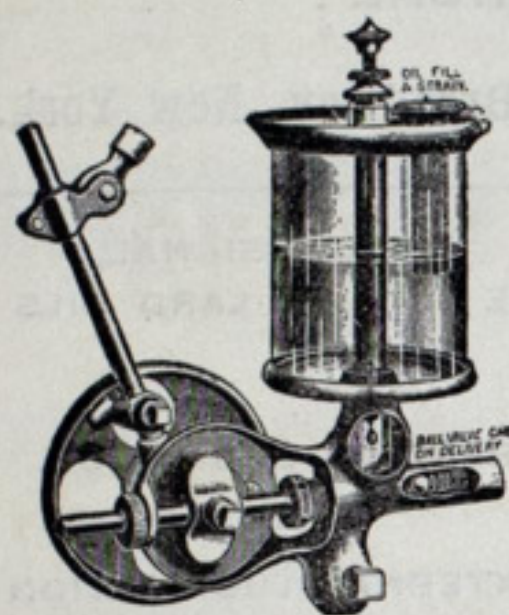


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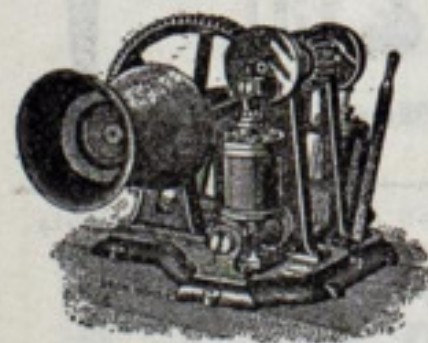


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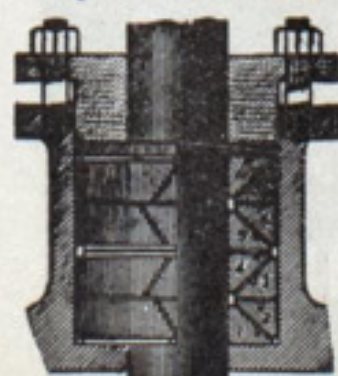
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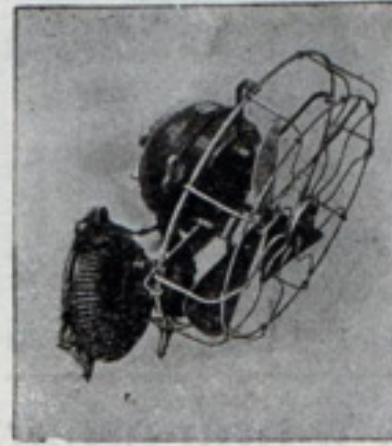
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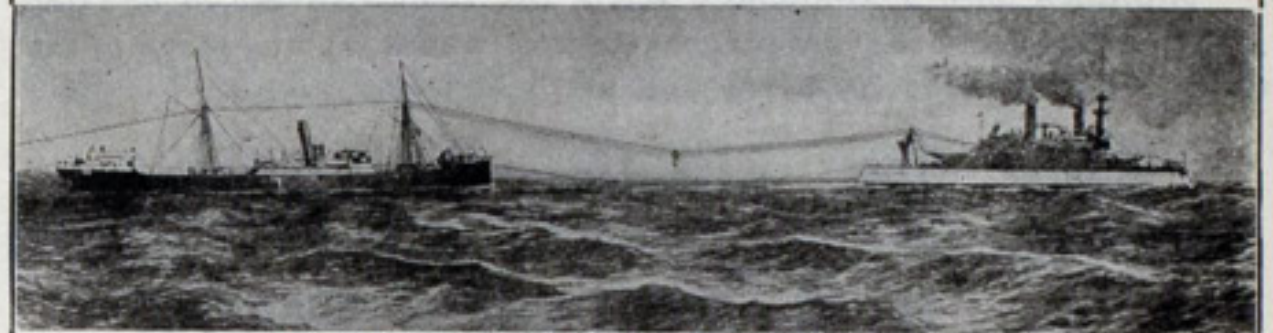
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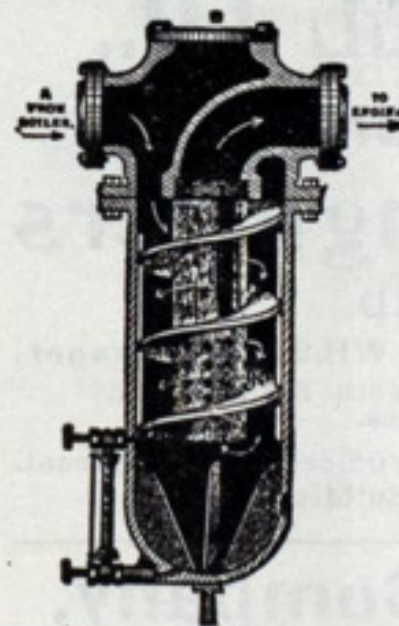
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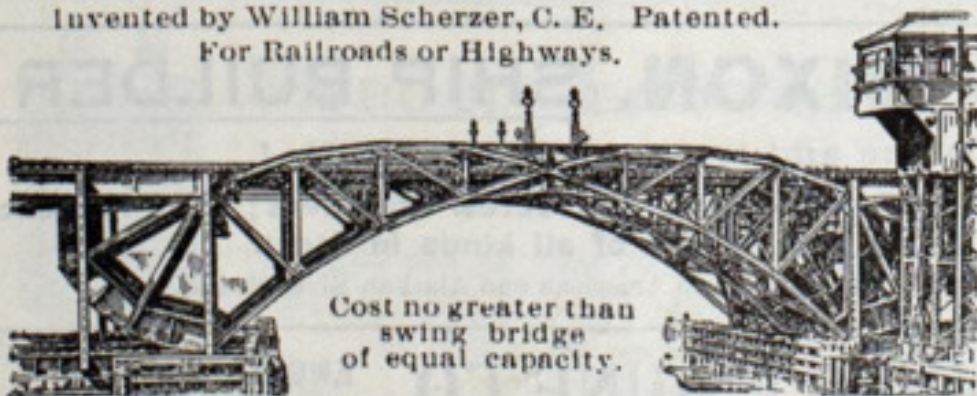
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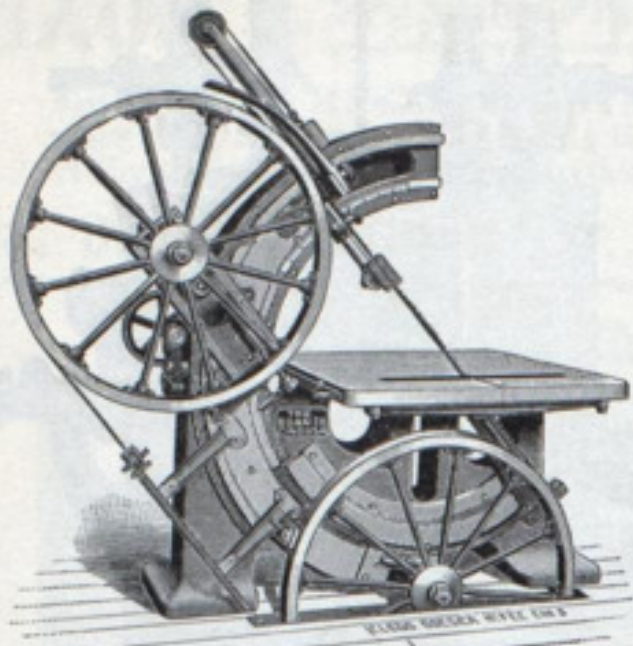
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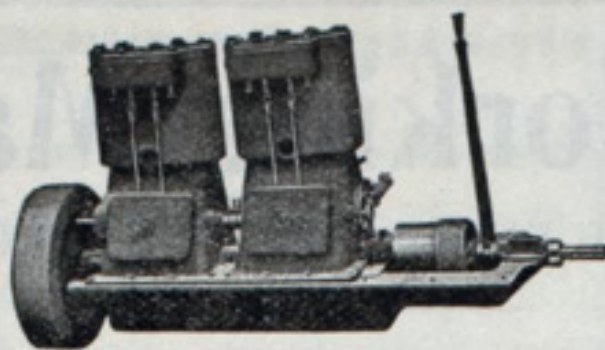
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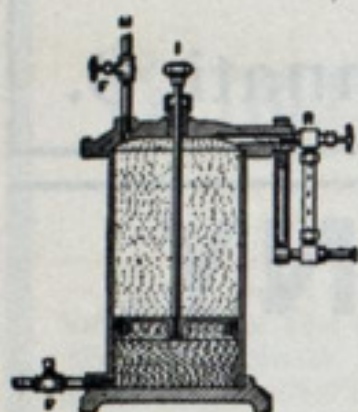
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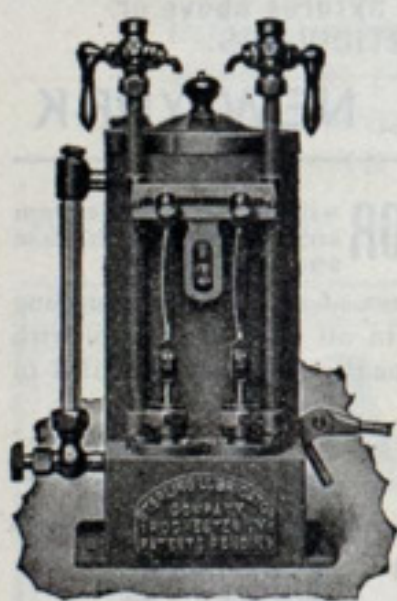
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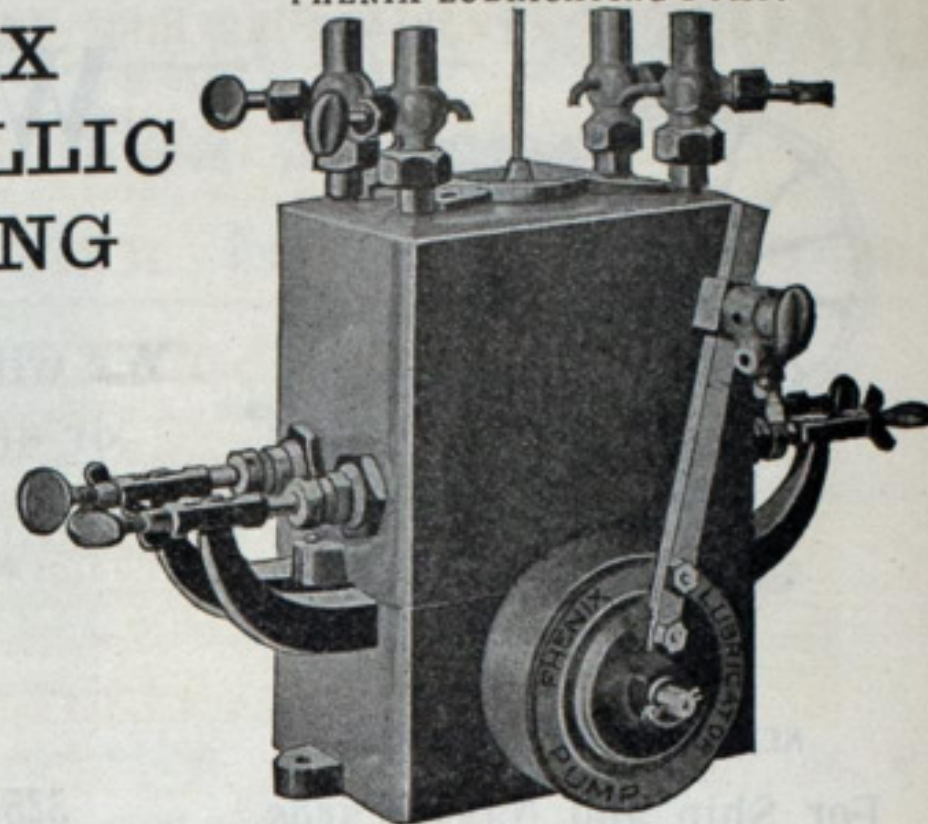
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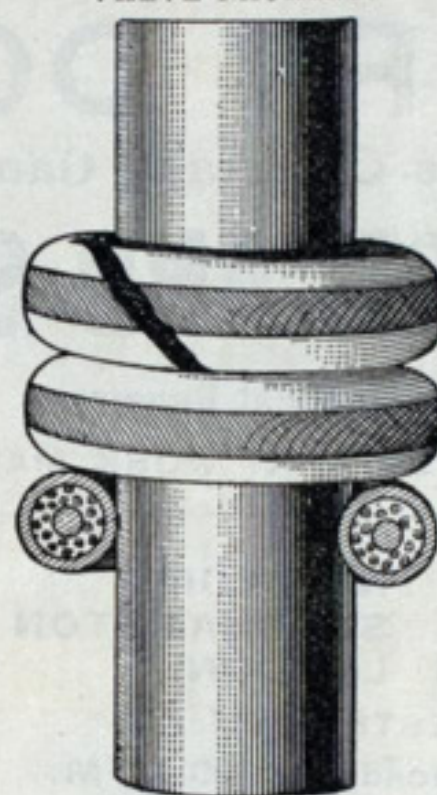
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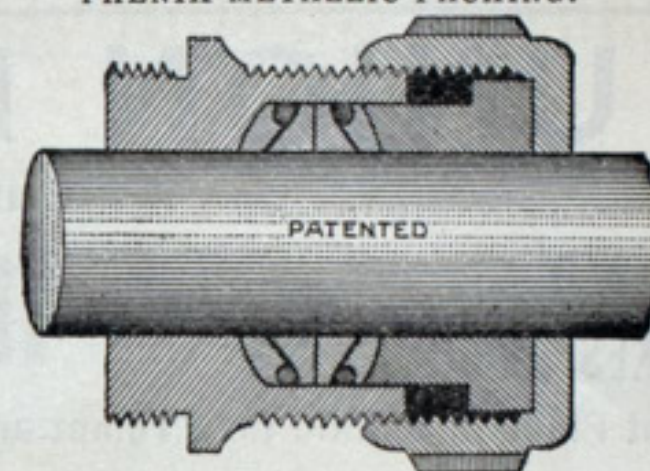


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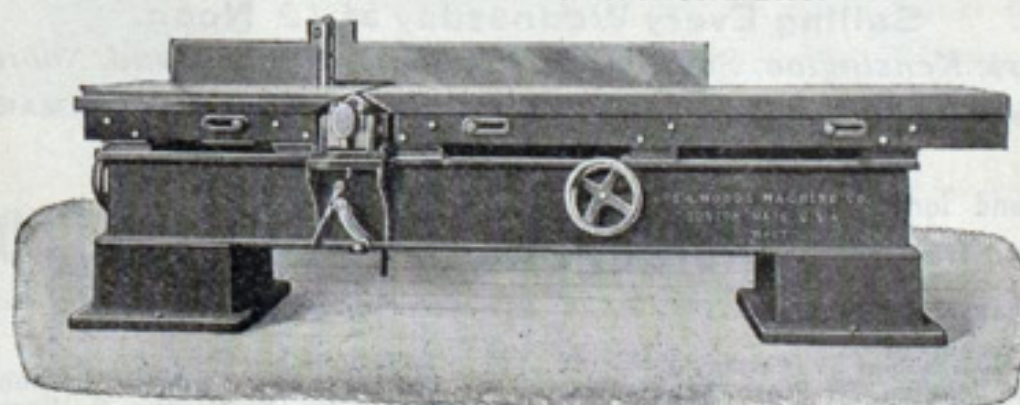
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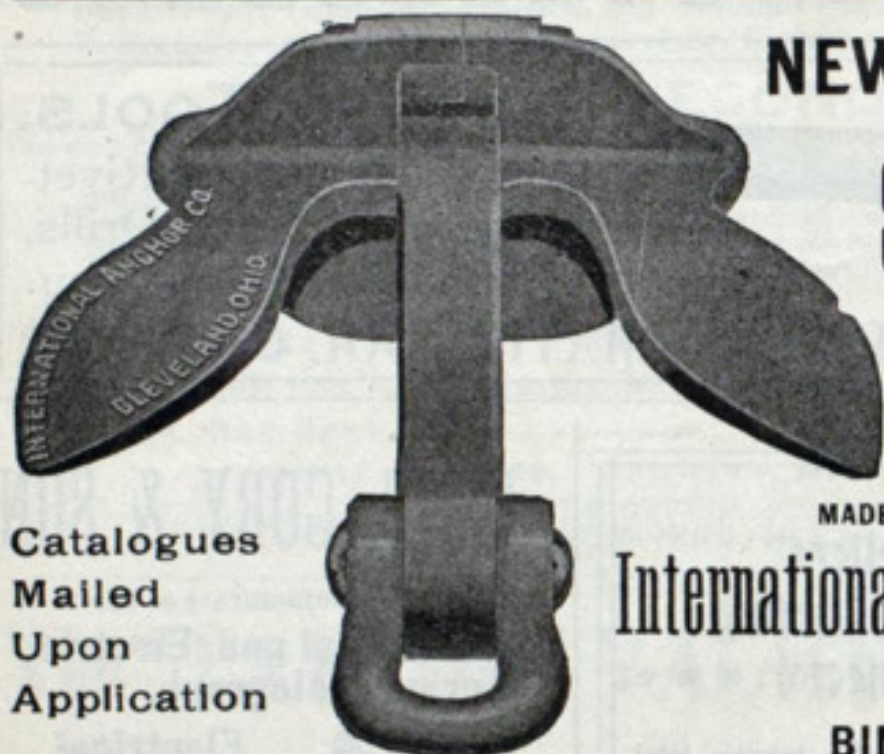
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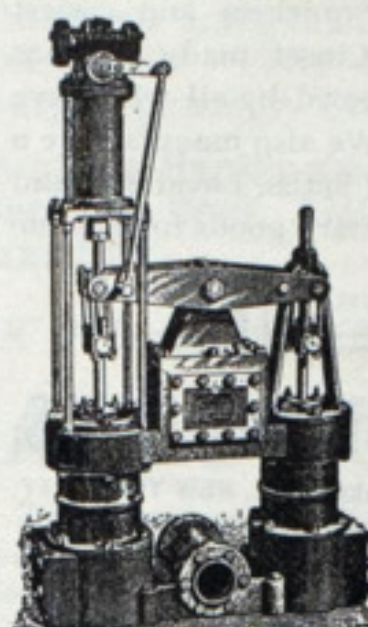
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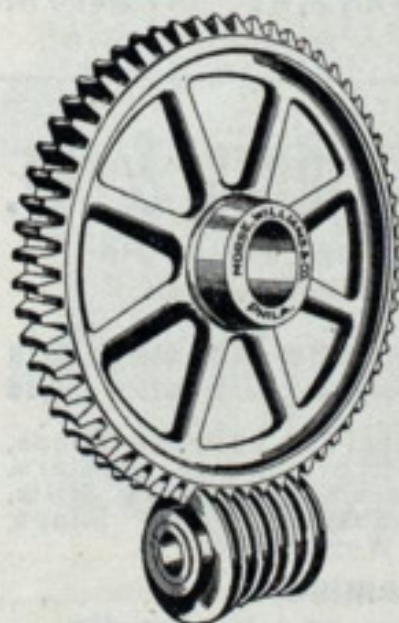
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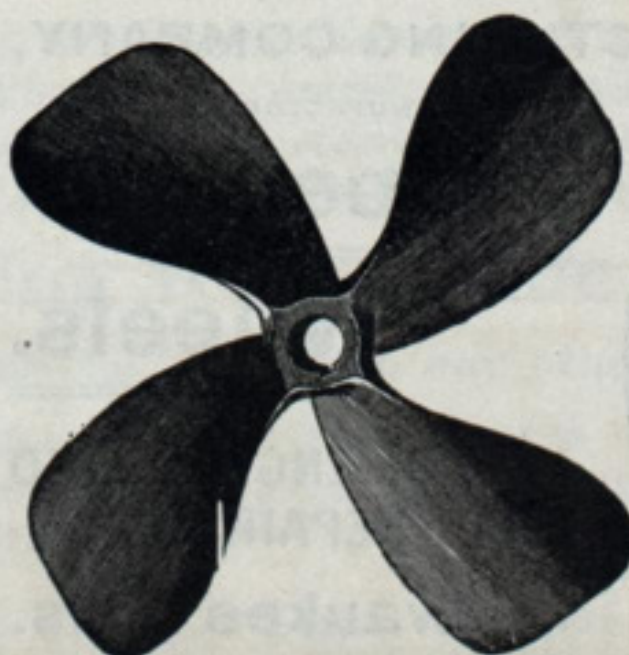
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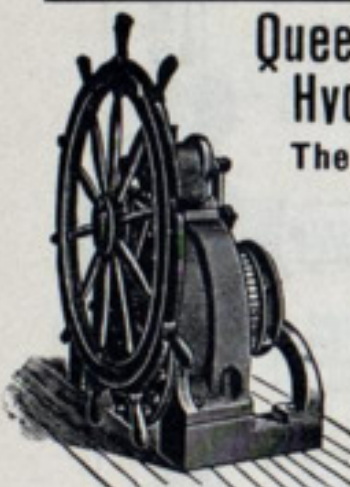
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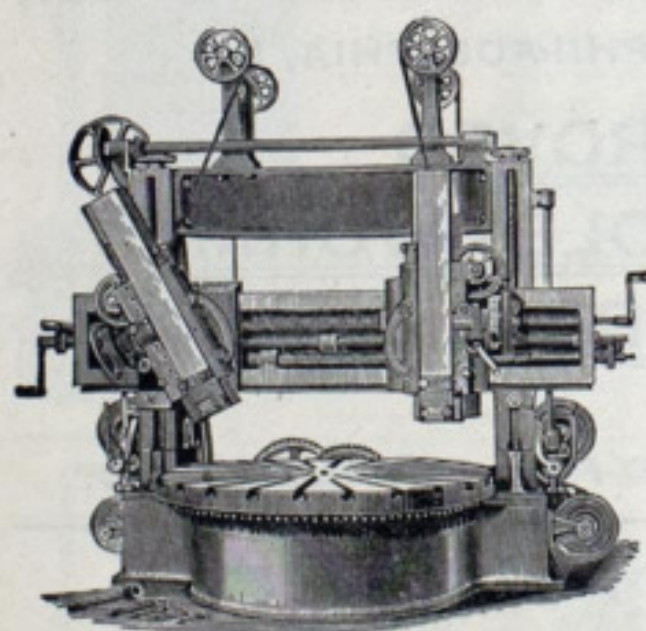
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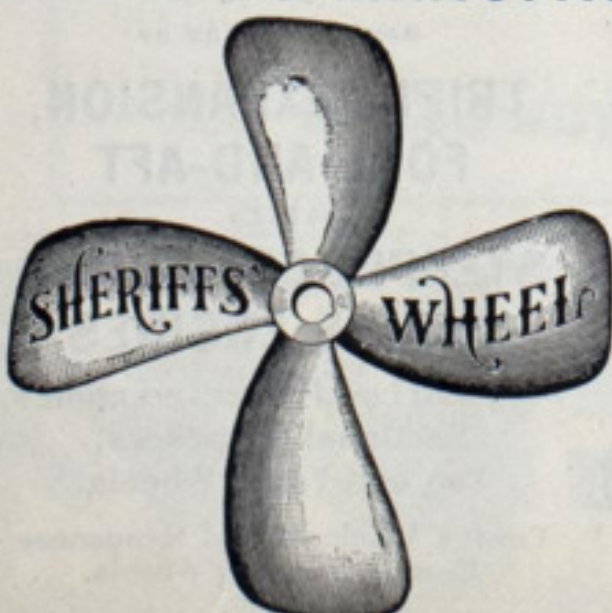
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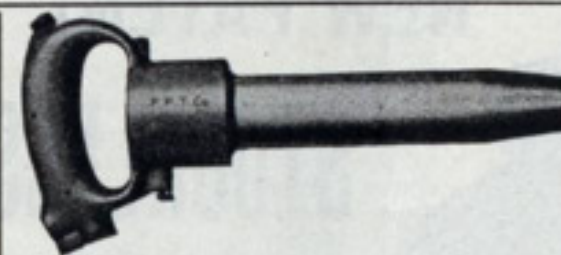
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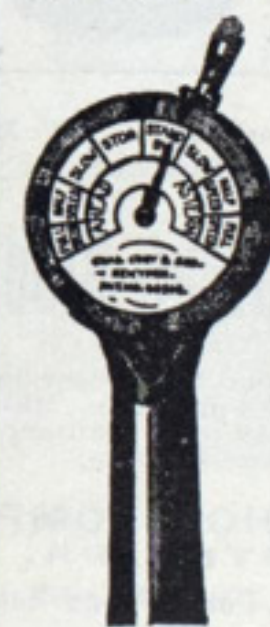
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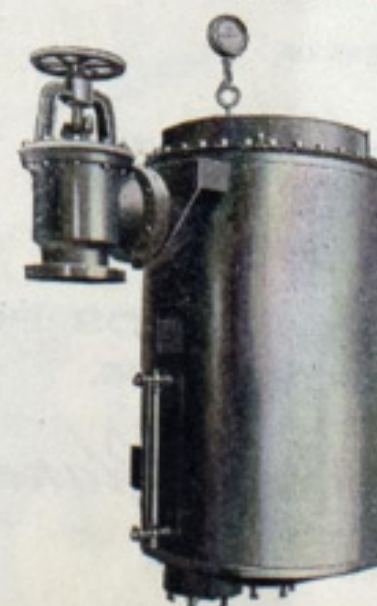


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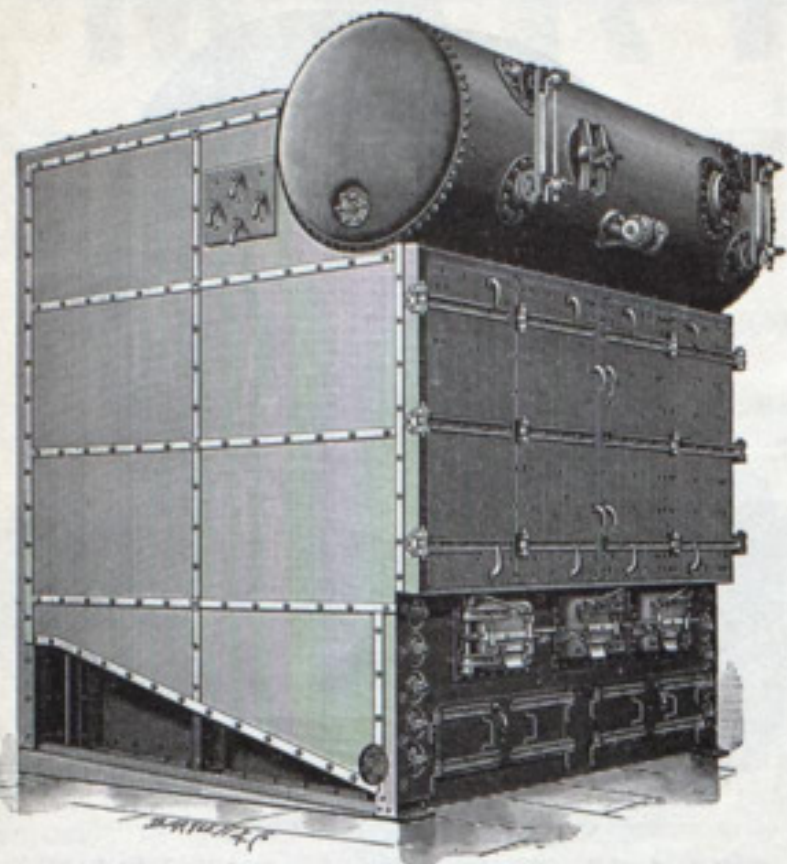
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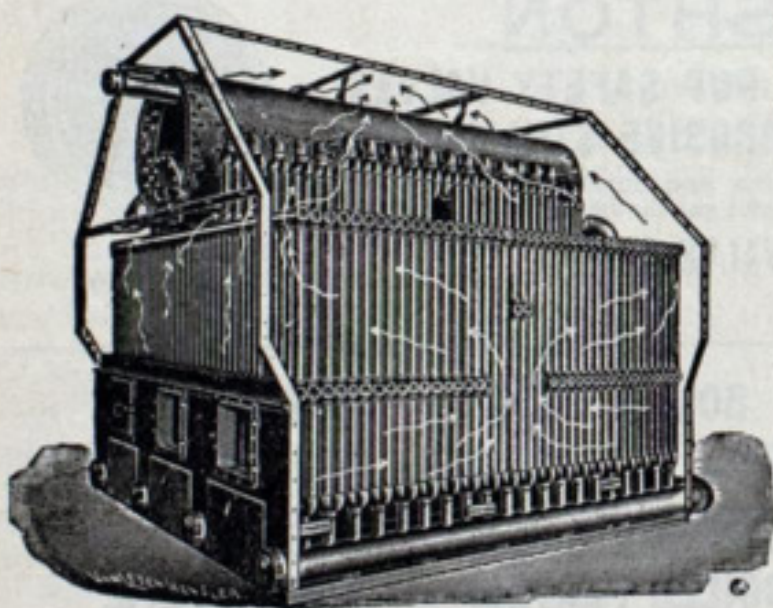
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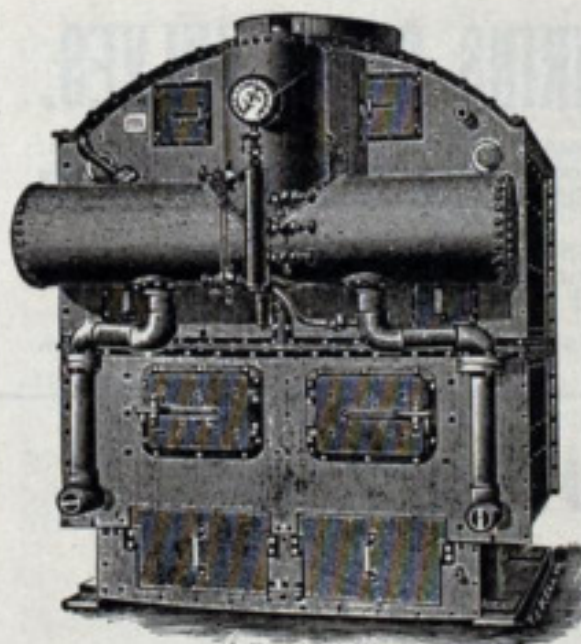
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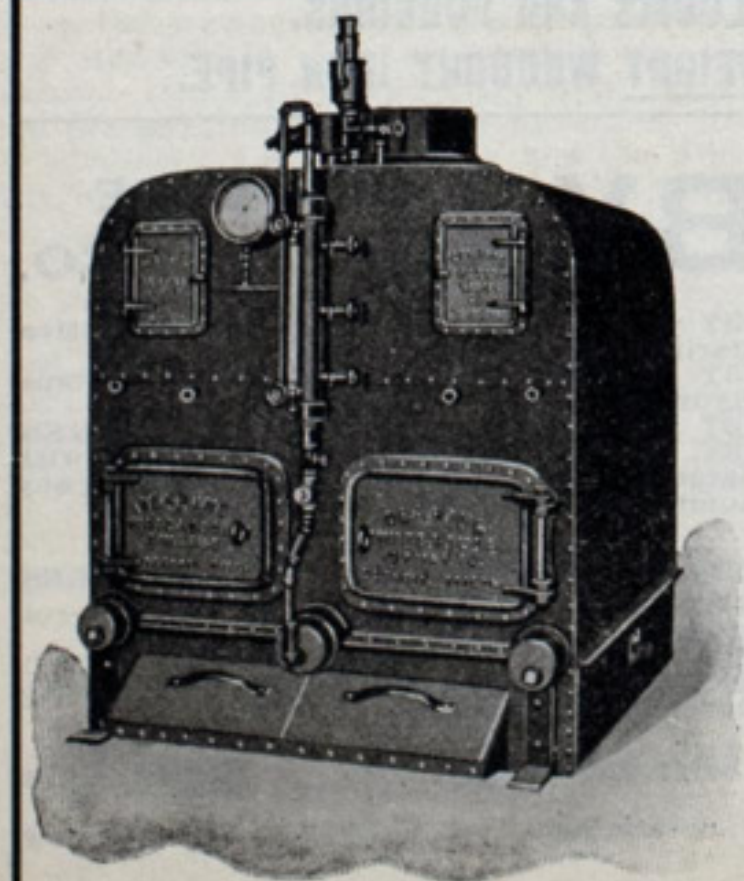
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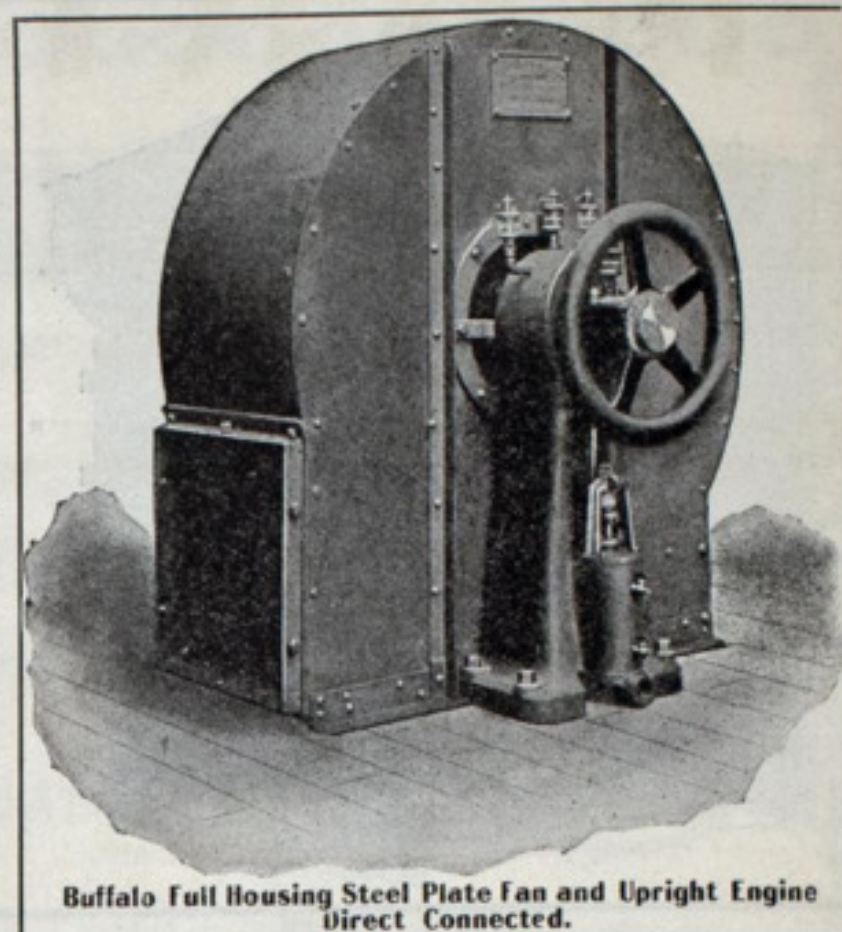
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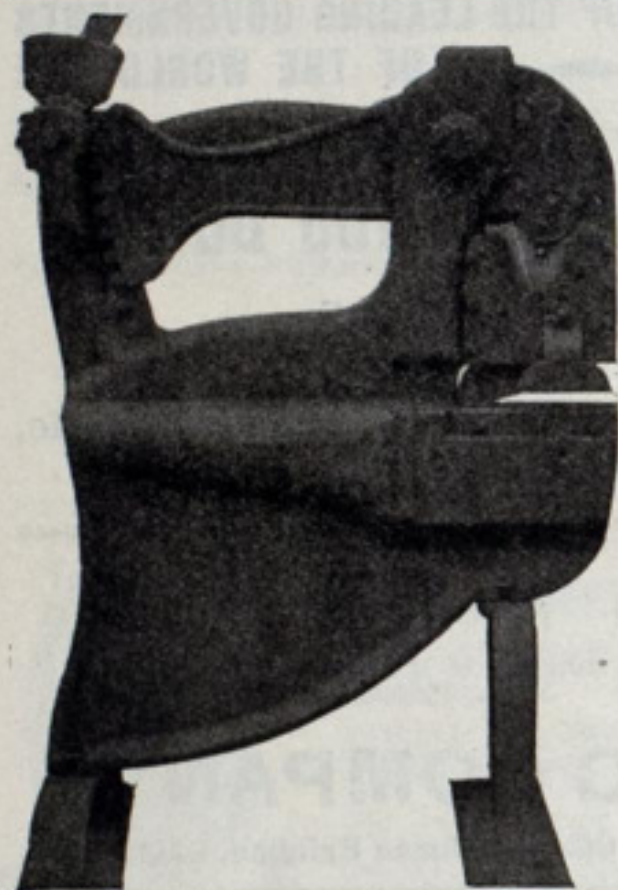
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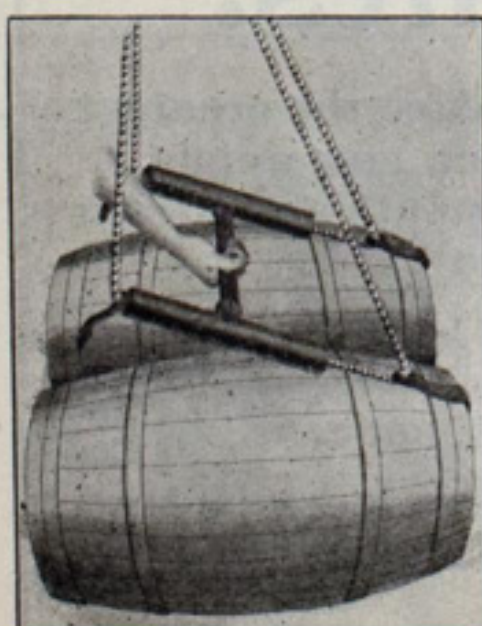
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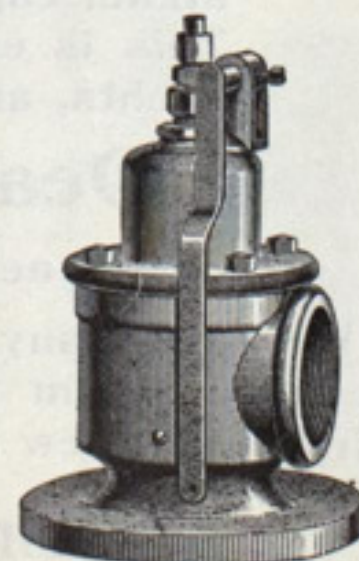
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